Welding Engineer

October, 1960
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In this issue: ***Welding and brazing in the piping industry***

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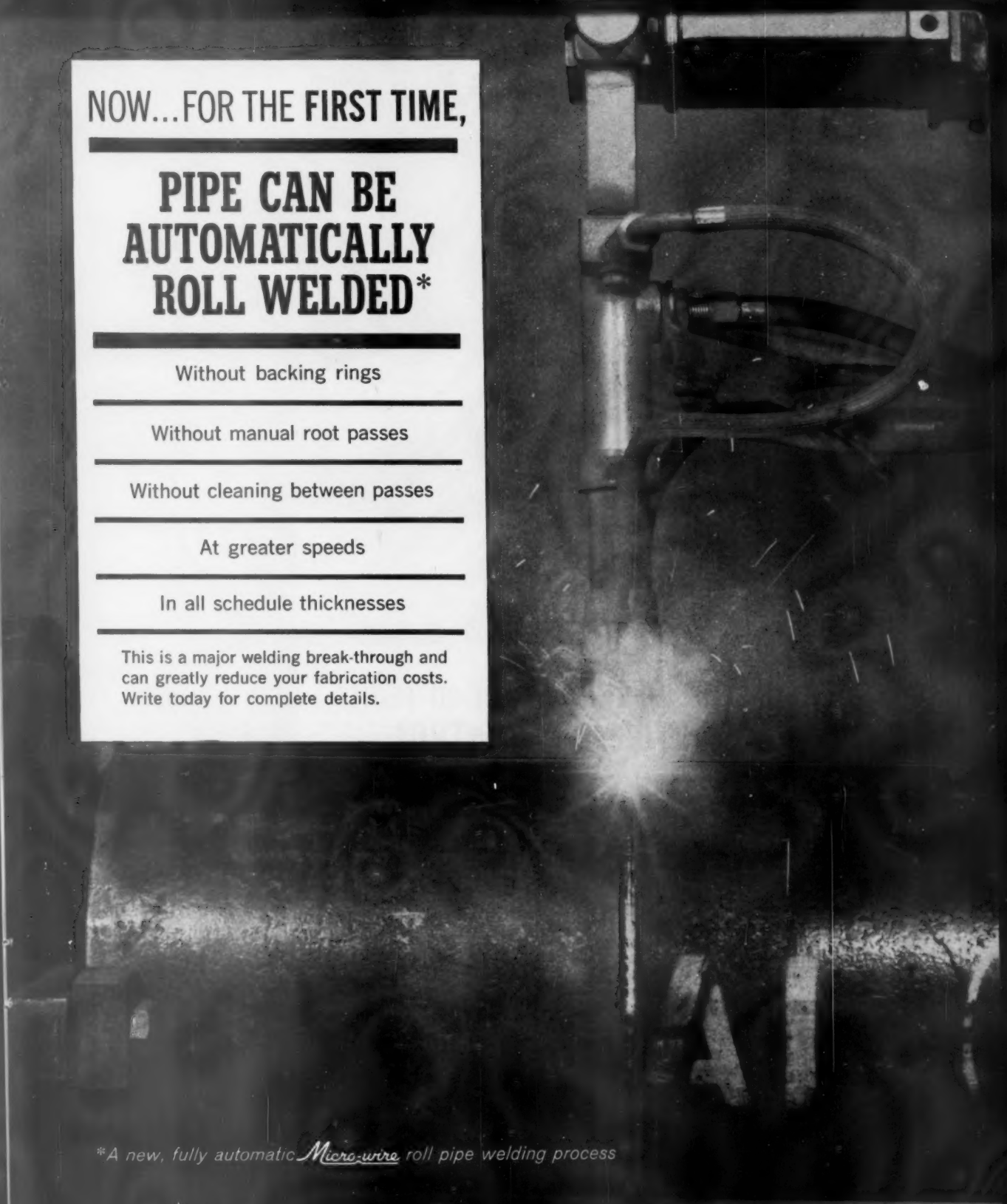

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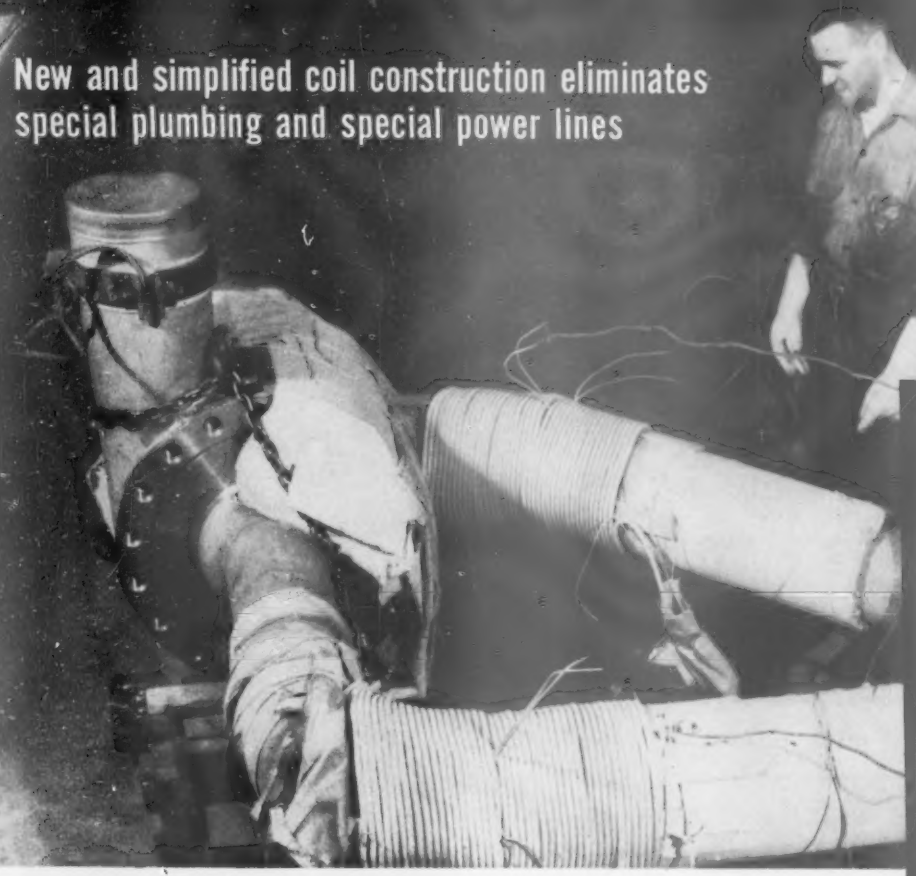

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VOL. 45—No. 10

Welding Engineer

The magazine of joining and severing of materials

This is welding: October, 1960

Cover photo . . . welding on a natural gas pipeline. Courtesy of INA — Insurance by North America.

Welding and brazing in the piping industry 31
From bamboo-like reeds to welded pipe . . . a short history of man's pipelining procedures.

How to design tee-joints for piping 33
These joints may look simple, but many factors govern their cutting and welding, as detailed by **S. A. Grubish.**
★ (For a reprint of this article, circle number 248.)

Thin-wire CO_2 process allows automatic pipe roll welding 36
Author **Howard B. Cary** reports how elimination of manual stringer beads and backing rings makes this piping method feasible.

Pipelining requires coordination, trained weldors 38
Now a mass production operation, pipelining can proceed at a mile or more a day — with welding an integral member of the team.

Variety is the spice in this pipe shop's life 40
This pipe shop's operations, as described by **F. T. Tancula,** fall into that exclusive distributor-fabricator category.

Pipe preparation can be easy with the proper tools 42
Development of various aids has simplified the weldor's problems of pipe layout and preparation before welding.

How to use radiography in pipeline construction 44
The advantages and disadvantages of X-ray and gamma ray inspection are accurately weighed by author **J. R. Strebelle.**
★ (For a reprint of this article, circle number 249.)

How to braze piping 52
This definitive report by **Alden W. Swift** explains the basic principles (and some special techniques) of this pipe-joining method.
★ (For a reprint of this article, circle number 250.)

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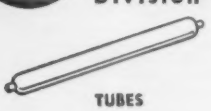
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Welding Engineer

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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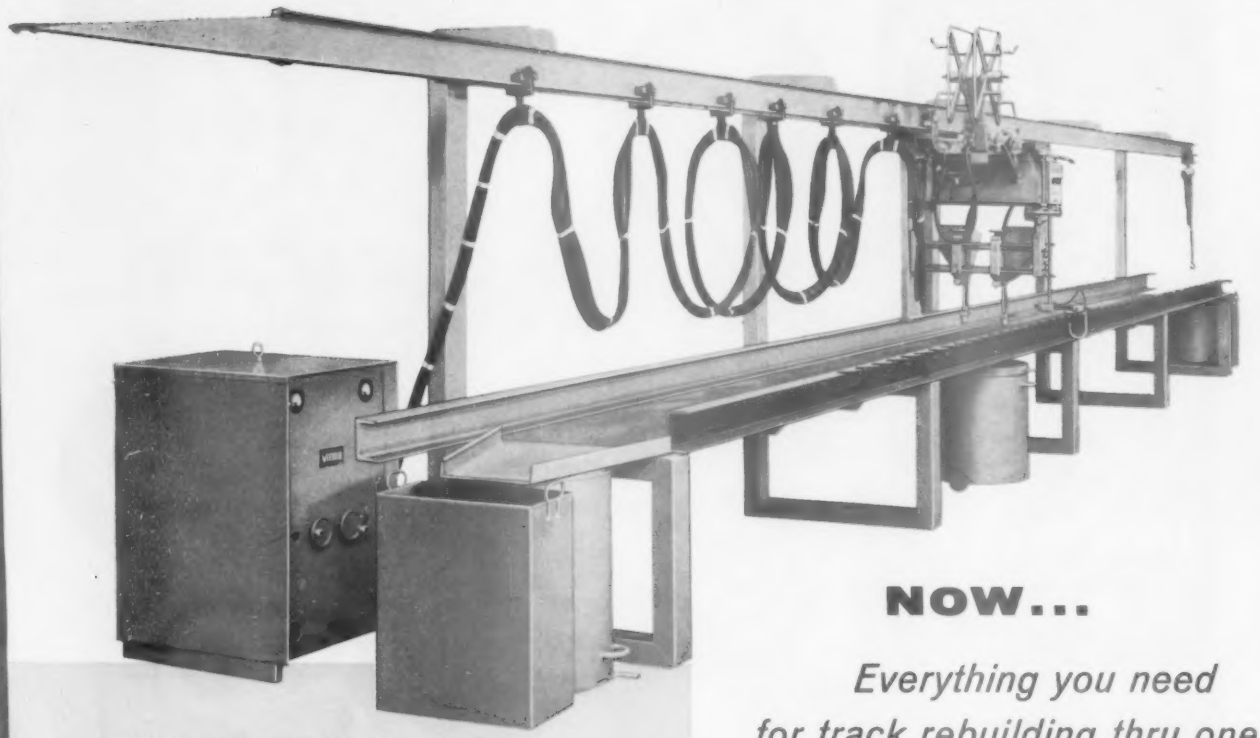
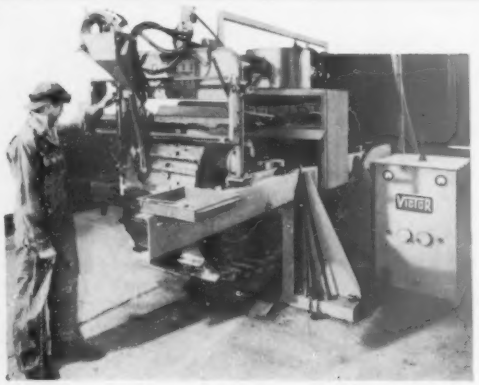


VICTOR AUTOMATIC TRACK LINK REBUILDER

adjusts easily to all track links. Dual wire feed automatically hardfaces links on both sides of track simultaneously. Modular design enables you to lengthen rebuilder, so operator controls welding on one set of tracks, while assistant is preparing second set. Your choice of Model TLM-2 (shown) or build-it-yourself Model TLM-A. Roller and idler rebuilding attachment available as accessory.



VICTOR GROUSER BAR WELDER,

the first completely automatic machine for this work, cuts grouser rebuilding time in half—and does a more uniform job, too. It's self-loading, handles all size tracks without disassembly. Machine automatically trims grouser bar and holds it in precurved position that prevents bowing after welding.

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Everything you need for track rebuilding thru one source...your Victor dealer

That's right — you now can get from your Victor dealer everything you need — **rebuilding machines, hardfacing wire, service** and **parts** — for rebuilding tractor rollers, idlers, links, grousers, etc. Here's what this package, backed by Victor, includes:

Complete line of machines for build-up, hardening, and finishing tracks to like-new condition. (Two only shown here.) These machines are built by internationally known L&B Welding Equipment, Inc., a wholly-owned Victor subsidiary.

Victor's own VA4X and VA5X continuous-coil, hardfacing wires, developed especially for use with automatic rebuilders. Coil uniformity guaranteed.

Overnight shipment of parts and prompt repair service by factory experts. Help on shop layout, installation, operator training and rebuilding counsel.

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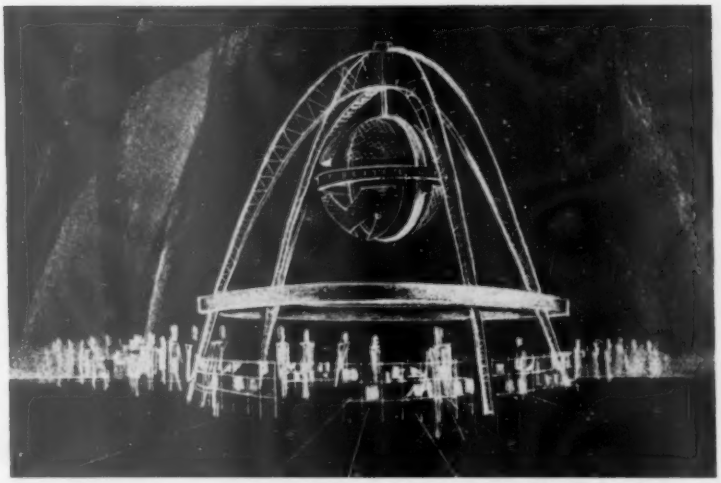


ONE of the focal points of the 1960 show will be this steel "quadrilon," 34-ft high. Arrayed about the crossed arches will be exhibits of 16 major steel firms.

11 categories to highlight Philadelphia Metal Show

The greatest concentration of technical exhibits on metals, materials, and processes in the 42-year history of American Society for Metals shows awaits the estimated 25,000 visitors to this year's National Metal Congress and Exposition.

Converging at Philadelphia's Trade and Convention Center from Oct. 17 to 21, the registrants will see a featured Steel Arena, housing displays of 16 of the nation's major steel companies. In addition, three other halls in the center will contain more than 200 exhibits from other metals areas.

Exhibitors have been grouped in 11 categories: ferrous metals, non-ferrous metals, related engineering materials, nuclear materials, tool materials, industrial heating, cleaning and finishing, welding and joining, testing, inspection and control, metals production and casting, and parts, forms and shapes for design and application.

Tom C. Campbell, editor-in-chief of *The Iron Age*, will present the featured address at ASM's annual dinner, the evening of Oct. 20 in the Bellevue-Stratford Hotel.

Major awards, medals and lectureships will be presented at the dinner, including the William H. Eisenman Award for engineering achievement.

The Campbell Memorial Lectureship will be given by Dr. Clarence Zener, director of Westinghouse Research Laboratories, Pittsburgh, following the annual meeting on the evening of Oct. 19.

Dr. William A. Pennington, professor of metallurgy at the University of Maryland, currently serving as vice president of the ASM, will be nominated for organization president. Named to succeed him as vice president is Dr. Carl E. Swartz, consultant in metallurgy and materials.

Merrill A. Scheil, director of metallurgical research for A. O. Smith Corp., Milwaukee, will be nominated for a two-year term as secretary, and Dr. Morris Cohen, professor of physical metallurgy at Massachusetts Institute of Technology, and Dr. John Convey, director of the Mines Branch, Ottawa, Canada, will be named as trustees.

Since no additional nominations were received, a unanimous vote will be cast for the entire slate of nominees during the meeting. The new men will assume office at the close of the congress.

Leading metallographers from throughout the world will present more than 300 examples of their work in a special exhibit at the show.

A focal area of the show will be the dramatic theme tower in the Steel Arena. An all-steel "quadrilon" will rise 34 ft above the exhibit floor carrying a huge steel sphere featuring the ASM seal.

Welding equipment manufacturers and suppliers who will be represented at the show include the following:

Banner Welder, Inc.; Bren Weld Corp.; Aro Spot Welder Div.; High Vacuum Equipment Corp.; KSM Products, Inc.; Kester Solder Co.; Lepel High Frequency Labs, Inc.; Lindberg Engineering Co.; Raytheon Corp.; Selas Corp. of America; A. O. Smith Corp.

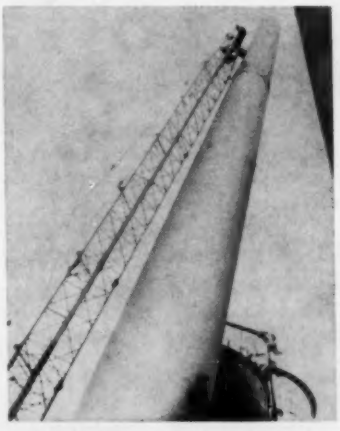
Testing, inspection and control manufacturers and suppliers represented will include:

Balteau Electric Corp.; Bausch & Lomb Inc.; Budd Co.; Curtiss-Wright Corp., Princeton Div.; Detroit Testing Machine Co.; Eastman Kodak Co.; Englehard Industries, Inc.; Hevi-Duty Electric Co.; Magnaflux Corp.; Markal Co.; Narda Ultrasonics Corp.; Picker X-ray Corp.; Pyrometer Instrument Co.

October's Headlines

Welsh opens new midwestern warehouse

Welsh Mfg. Co., Providence, R. I., has opened a new midwestern warehouse, located at 1736 S. Michigan Ave., Chicago. Walter Johnson is manager.



NINETY-foot boom lifts a 150-ft-high, 5-ft-diameter wrought iron smoke stack at American Cyanamid Co., New Castle, Pa. The all-welded stack was fabricated from 72-in. x ½-in. x 188-in. 4-D wrought iron plate into stack sections and installed by Conn Welding Co., New Castle. It replaces a 10-year-old stack which partially collapsed during a storm last winter.

CHARTING exhibit areas for the Third AWS Western Welding Show are (from left) Don Powell, Linde Co.; Arnold Otto, Hipp Welding Co.; and Harry Gerin, Gerin Welding Sales.

COMING EVENTS

OCT. 4-6: AEC Welding Forum, Hilton Hotel, San Antonio, Tex.

OCT. 13-15: AWS Western Welding Show, Exposition Hall, Santa Clara County Fair Grounds, San Jose, Calif.

OCT. 17-18: NWSA West Central Zone meeting, Hotel Muehlebach, Kansas City.

OCT. 17-21: 48th Annual Safety Congress, Chicago; 1960 National Metal Show, Trade and Convention Center, Philadelphia.

OCT. 21-22: NWSA Western Zone meeting, Ambassador Hotel, Los Angeles.

OCT. 23-25: AIRPS Annual Convention and Trade Show, Chase Park Plaza Hotel, St. Louis.

NOV. 28-29: NWSA Southeastern Zone meeting, Hillsboro Hotel, Tampa.

DEC. 1-2: NWSA Southwestern Zone meeting, Hotel Roosevelt, New Orleans.

DEC. 5-8: 1st Biennial Short Course on Welding Engineering, University of Illinois, Urbana, Ill.

MAR. 24-25, 1961: Welding Show & Exhibit, Wichita Section AWS, Kansas National Guard Armory, Wichita, Kans.

26 firms contract for Western Welding Show

Metalworking representatives from every state west of the Rockies will attend the Third American Welding Society Western Welding Show in San Jose, Calif., at the Santa Clara County Fairgrounds, Oct. 13-15.

To date 26 firms have contracted for participation in the exhibit, which is to be held in conjunction with the Western Welding Technical Conference, in session the same days at the St. Claire Hotel in San Jose.

Displays will be open to the public Oct. 13 from 2 to 10 p. m.; Oct. 14 from 10 a. m. to 10 p. m.; and Oct. 15 from 10 a. m to 4 p. m.

The two-and-a-half-day technical conference will begin with registration at 8 a. m. Oct. 13. Discussion periods during the first day's program will include presentation of papers on welding of stainless steel, nickel alloys and welding alloys.

On Oct. 14 topics will include aspects of welding alloys for high temperature service and welding and brazing in the electronics industry. The concluding half-day session, Oct. 15, will be devoted to welding of aluminum.

12,000 expected to attend 48th safety congress

Close to 12,000 safety specialists from the U. S., Canada, and several foreign countries are expected at the 48th National Safety Congress, to be held in Chicago.

Three hundred sessions on all kinds of safety along with hundreds of exhibits of safety devices and products will be included in the 5-day meeting, Oct. 17-21.

Speakers at the Congress will include Gen. Alfred M. Gruenther, who will discuss "American Responsibility in a World of Missiles and Misunderstandings" at a banquet the evening of Oct. 18; Sen. Robert S. Kerr (D-Okla.); and Brig. Gen. Walter E. Arnold, director of flight and missile safety research, Norton Air Force Base, Calif.

Non-destructive testing courses scheduled

Courses in ultrasonic inspection techniques and in industrial isotope radiography, given by the Princeton Div., Curtiss-Wright Corp., Princeton, N. J., are scheduled for early October.

The ultrasonic inspection course will be held from 8:30 a.m. Oct. 3 until 5 p.m. Oct. 7 at the nondestructive testing laboratories in Princeton, and will cover both contact and immersion techniques. Special emphasis will be given to inspection of pipe and tubing.

Industrial radiography, also to be given at the testing laboratories, will run from 8:30 a.m. Oct. 10 to 5 p.m. Oct. 14. This course will cover selection, darkroom techniques, and instrumentation.

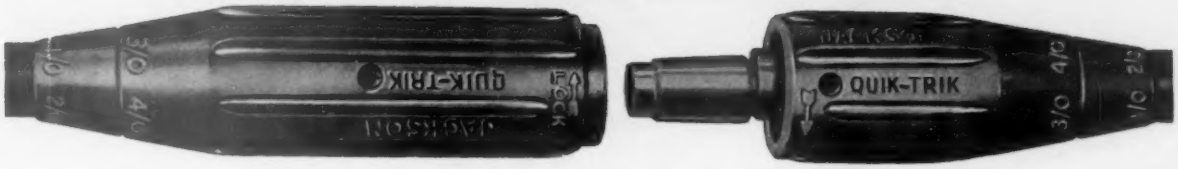
(More news on page 94)

Portable clean-room developed

CONFRONTED with the problem of welding various components on heat exchanger equipment tube bundles, which may measure 40 or more ft long in some cases, American-Standard Corp. Industrial Div. engineers designed a portable clean-room that can be expected to contain tube bundles of nearly any length. When room is not in use, it is easily dismantled and stacked in sections. Constructed of hardboard side panels and a heavy-duty polyethylene top, the room is expandable in 6-ft. lengths.

Jackson GROUND CLAMPS*

CABLE CONNECTORS†



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* Jackson Ground Clamps work easily and efficiently. One end fits the hand, with finger-grooved lower tong. Proper placement—current-carrying upper tong on top where you're sure of good contact—is natural and easy.

The business end fits the job. The contact area of the copper alloy upper tong is large and flat, with serrations that bite through surface film. Greater contact area carries current efficiently. New melamine-impregnated fiber glass insulators at pivot keeps current out of lower tong.

† Jackson 'Quik-Trik' Cable Connectors have streamlined Neoprene rubber insulators that lock out moisture, dirt, and don't catch on obstructions. Cable connects mechanically, or by soldering or brazing. The reduced tip diameter on the tapered plug takes hard knocks without forming a burr that will interfere with the mating of the halves.

Models to fit cable sizes 1 thru 4/0, sold everywhere by better welding supply dealers

Jackson Products

AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

31739 Mound Road, Warren, Michigan

No danger to these welds from hydrogen embrittlement. They're produced with Inco-Weld "A"; carbon steel flanges to stainless steel jacket, stainless steel jacket to Inconel* nickel-chromium alloy plate.

Inconel alloy to stainless steel to carbon steel ...Versatile Inco-Weld "A" Wire joins all 3

This retort is destined for brazing and bright annealing at working temperatures up to 2100°F in dry hydrogen atmosphere.

The welding problem was to obtain joints between three dissimilar metals: Inconel alloy, stainless steel, and carbon steel. These joints had to resist oxidation, resist cracking due to hydrogen embrittlement, and at the same time remain strong at high temperatures.

Rolock, Inc. of Fairfield, Connecticut, produced the desired welds with a *single* material, Inco-Weld "A"* wire. This wire, it has been demonstrated, will produce X-ray quality welds between 97% of all weldable dissimilar alloy combinations. What's more, the Inco-Weld "A" deposit matches (or betters) the heat and corrosion resistance of most parent metals. Other advantages include:

1. High tolerance for dilution of base metals without forming brittle or crack sensitive alloys.
2. Moderate coefficient of expansion.
3. Ability to withstand high service temperatures over long periods of time.

Inco-Weld "A" wire and electrodes are easy to use. No special equipment is required. Arcs are spray-type. Work seldom needs pre-heating.

Both wire and rod are available in standard diameters and forms, and conveniently packaged.

You can get further particulars on the use of Inco-Weld "A" in joining many dissimilar alloy combinations from our folder, "Now You Can Weld Dissimilar Alloys Quickly and Easily." If you don't have a copy, write:

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

INCO TRADE MARK **WELDING PRODUCTS**
electrodes · wire · fluxes

WELDING ENGINEER

Your October, 1960 *Weld World*

As WE went to press, these were the industry's latest developments:

. . After more than three years of study, a single specification for covered welding electrodes has been prepared by the Arc Welding Section of NEMA and the U. S. Bureau of Ships. More details next month.

. . You now can rent positioning equipment. Ransome Co. has instituted a plan whereby all standard models and many of its special models can be rented directly from the firm for any desired period.

. . Aluminum Co. of America has acquired foreign rights to sell and also license the manufacture of Sonobond ultrasonic joining equipment. Sonobond Div. is a subsidiary of Aeroprojects, Inc., West Chester, Pa.

. . Another member of the welding industry has instituted scholarships in welding engineering at Ohio State University. National Cylinder Gas Div., Chemetron Corp., Chicago, has provided for two such grants. The university will administer the funds and will choose the recipients.

. . Boesch Mfg. Co., Danbury, Conn., has been purchased (for $800,000 cash) by Waltham Precision Instrument Co., Inc., Waltham, Mass. Boesch makes welding positioners and coil winding machines.

. . Linde Co., New York City, has given up manufacture and sale of cylinders for propane, refrigerant and anhydrous ammonia service. Cylinder-producing machinery has been sold to Cylinders, Inc., an affiliate of Newark Steel Drum Co., Linden, N. J., effective Oct. 1. Reason for sale: Linde's need to expand production of a number of cryogenic products.

. . Branson Instruments, Inc., Stamford, Conn., has obtained a half interest in Radionics, Inc., Norristown, Pa. Radionics, formerly known as Radiation Engineered Services, makes gamma radiography equipment. Transaction was for cash. At the same time, Branson, through stock exchange, acquired Colin Campbell Co., Inc., Danbury, Conn., manufacturer of electronic devices.

. . Shielded Stud Welding Co., Long Beach, Calif., recently issued a paid-up non-exclusive license for its aluminum inert-gas stud welding process to Gregory Industries, Inc., Lorain, Ohio, parent firm of Nelson Stud Welding Div., for an undisclosed sum.

. . Air Products, Inc., Allentown, Pa., will provide an oxygen plant adjacent an Italian steel mill. The firm's British affiliate, Air Products, Ltd., will build the 426-ton (daily capacity) plant for Cornigliano S. p. A. of Genoa.

. . About 500 miles of large-diameter steel pipe has been ordered from A. O. Smith Corp., Milwaukee, by Peoples Gas Light & Coke Co., Chicago. It's an estimated $25,000,000 order.

Letters...

Plastics welding

Sir: *Richmond, Va.*

In the August issue of *WE*, page 56, we read with interest the article on hot gas welding of thermoplastics.

Could you supply us with the name or names of concerns who manufacture or sell equipment for this process?

G. B. Watkins

(*Two such firms are: American Agile Corp., P. O. Box 168, Bedford, Ohio, and Laramy Products Co., 90 South St., Hingham, Mass. –Ed.*)

Sir: *Omaha, Neb.*

Your article in the August issue on welding of plastics was very interesting. Please advise us where we can obtain the book "Welding of Plastics" and torches suitable for welding plastics.

George A. Thrapp
Welders Supply Co.

(*American Agile Corp. can provide you with the book. Torches are available from American and from Laramy Products Co. at the addresses mentioned in the above note. — Ed.*)

Welding training

Sir: *Champlain, N. Y.*

Your article on page 31 of the August *WE* makes very good sense. It is true that we should have more people with more welding knowledge.

We operate a 300-man shop in Champlain and we have quite a welding department of which we are very proud. We also have a junior-senior high school which was built about a year ago. In it we have an industrial arts department which is not yet complete and we certainly think we should have welding equipment in the industrial arts room.

I would appreciate it if you could work out or have someone send me complete data on a welding setup for a junior-senior high school because the boys who graduate from this school usually wind up working for us in our plant. We have, in the last six or eight months, brought in quite a few of these boys and, in most cases, the arrangement has worked out very nicely.

I think a welding setup would be a very progressive movement in our industrial arts course. I am speaking as a school board member and also as plant manager of the Sheridan Iron Works.

John T. Zurlo

(*It would be difficult for us to advise you . . . primarily because we are not familiar with local conditions, the number of students in the school and the number available for such an industrial arts class, amount of space that might be devoted to such a class, as well as various state standards that might be involved. However, a person who might be able to help you is Philip C. Wolz, Rochester, N. Y., a past president of the New York State School Board Assn., who has had experience in setting up such classes. — Ed.*)

"What do you mean, 'it's a pretty spotty job' "?

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CONTOUR MARKERS

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

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NEW WEAR-O-MATIC WH Produces High Strength Manganese Attachment Welds Equal to 308 Stainless For PAGE ENGINEERING COMPANY

The Page Engineering Co. was founded in 1903 by Mr. John W. Page who originated the dragline method of digging. Today Page Engineering is the nation's leading manufacturer of dragline buckets, walking draglines and other equipment used in dragline operations.

High strength properties and crack free deposits are the two major requirements for welding alloys used to attach manganese parts to PAGE AUTOMATIC BUCKETS made of high strength alloy steel. Until recently, only type 308 stainless manual electrodes satisfactorily met both requirements. Other alloys have been tested from time to time but failed one or both tests leaving Page no choice but to continue using 308 stainless electrodes for critical joints.

Now, new Wear-O-Matic WH semi-automatic wire developed by Alloy Rods Company fills both the requirements by producing high strength properties identical to those of 308 stainless electrodes while depositing absolutely crack-free weld metal. The Page Engineering Co. has replaced most 308 stainless welding in their dragline bucket production with new Wear-O-Matic WH alloy, gaining the economies of semi-automatic open arc welding and retaining the same high strength requirements for manganese attachment welding. Page engineers report Wear-O-Matic WH gives them the additional advantages of faster deposition and smoother arc characteristics—better than any semi-automatic wire they have ever used in the production fabrication of dragline buckets.

You too, can benefit from the experiences of Page Engineering. For any application involving the high strength attachment welding of manganese, whether it be production fabrication of manganese parts or field maintenance, Wear-O-Matic WH will do the job better than any alloy you are now using and do it semi-automatically. Contact your Alloy Rods Company distributor or Hard Surfacing Specialist for specific application information. Or write direct to Alloy Rods Company, P. O. Box 1828, York 2, Pennsylvania.

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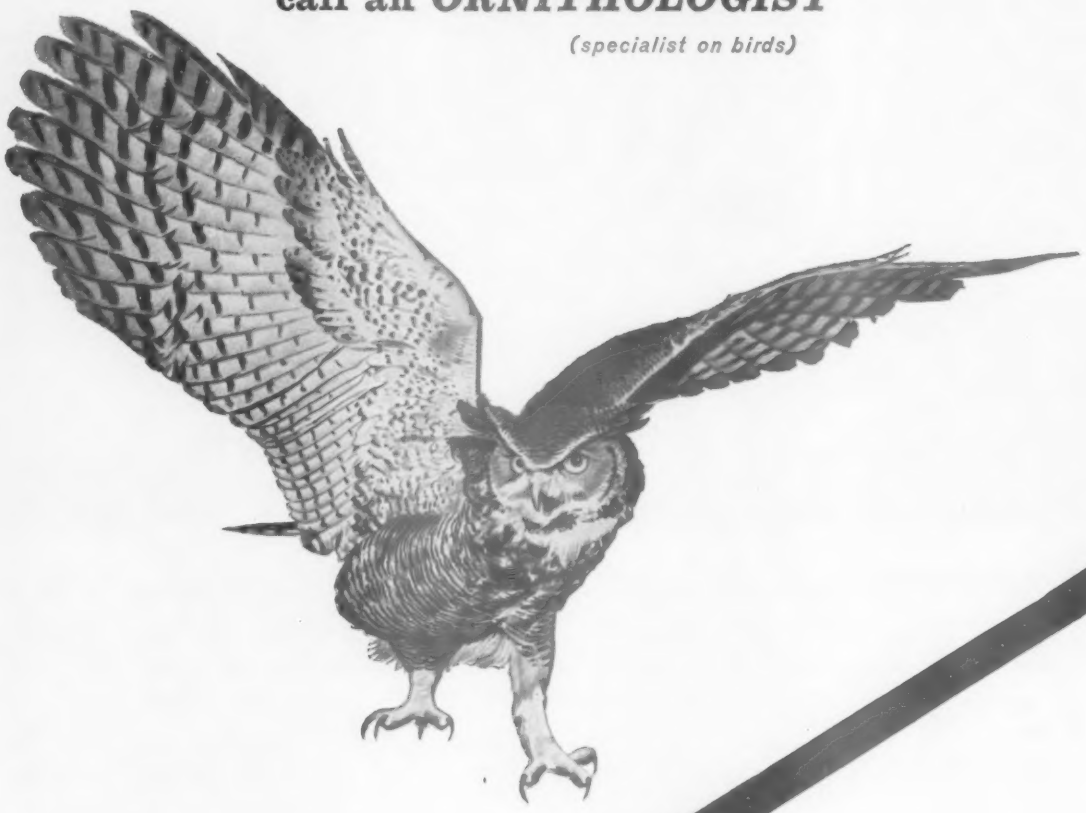
(specialist on birds)



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(specialists in arc welding)

A KANSAS MANUFACTURER OF MOBILE HOMES doubled the welding speed on his undercarriages by simply changing electrodes—and in addition, saved over $8000 in the first year.

Manufacturing cost on undercarriage fabrication was prohibitive. Thirteen gauge cross members were welded to twelve gauge channels by welds made in both vertical and flat positions. These short welds on steel having some scale and oil slowed down production.

Finally they called in their LINCOLN Field Engineer. Painstaking tests, made by the LINCOLN man with the welding foreman and plant superintendent, proved LINCOLN's Fleetweld 37 electrodes far better for this application.

RESULTS: lower costs . . . welding speed doubled . . . cleaning time cut in half.

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LINCOLN WELDERS

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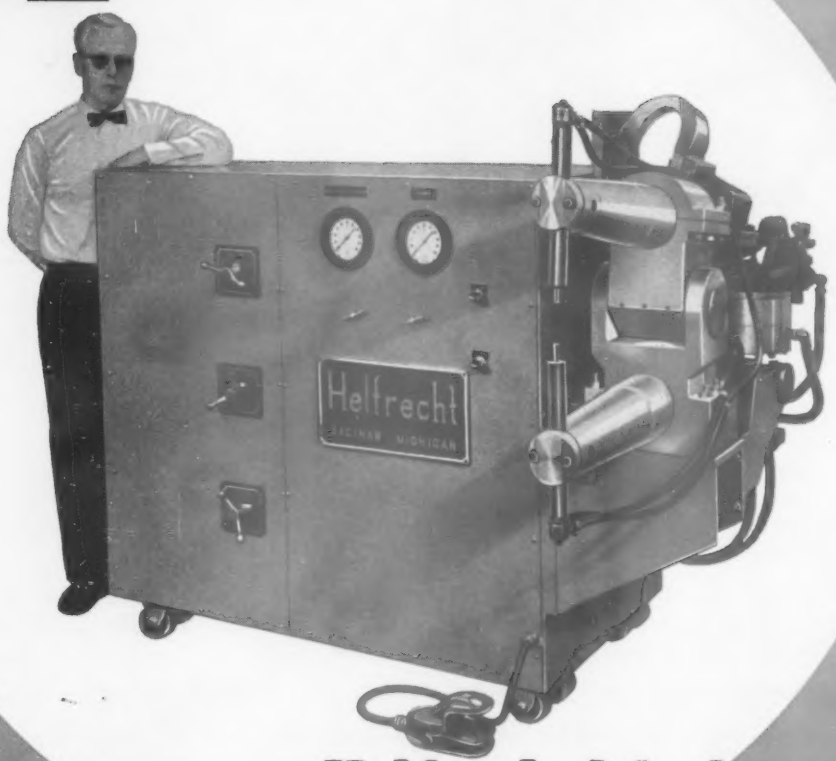

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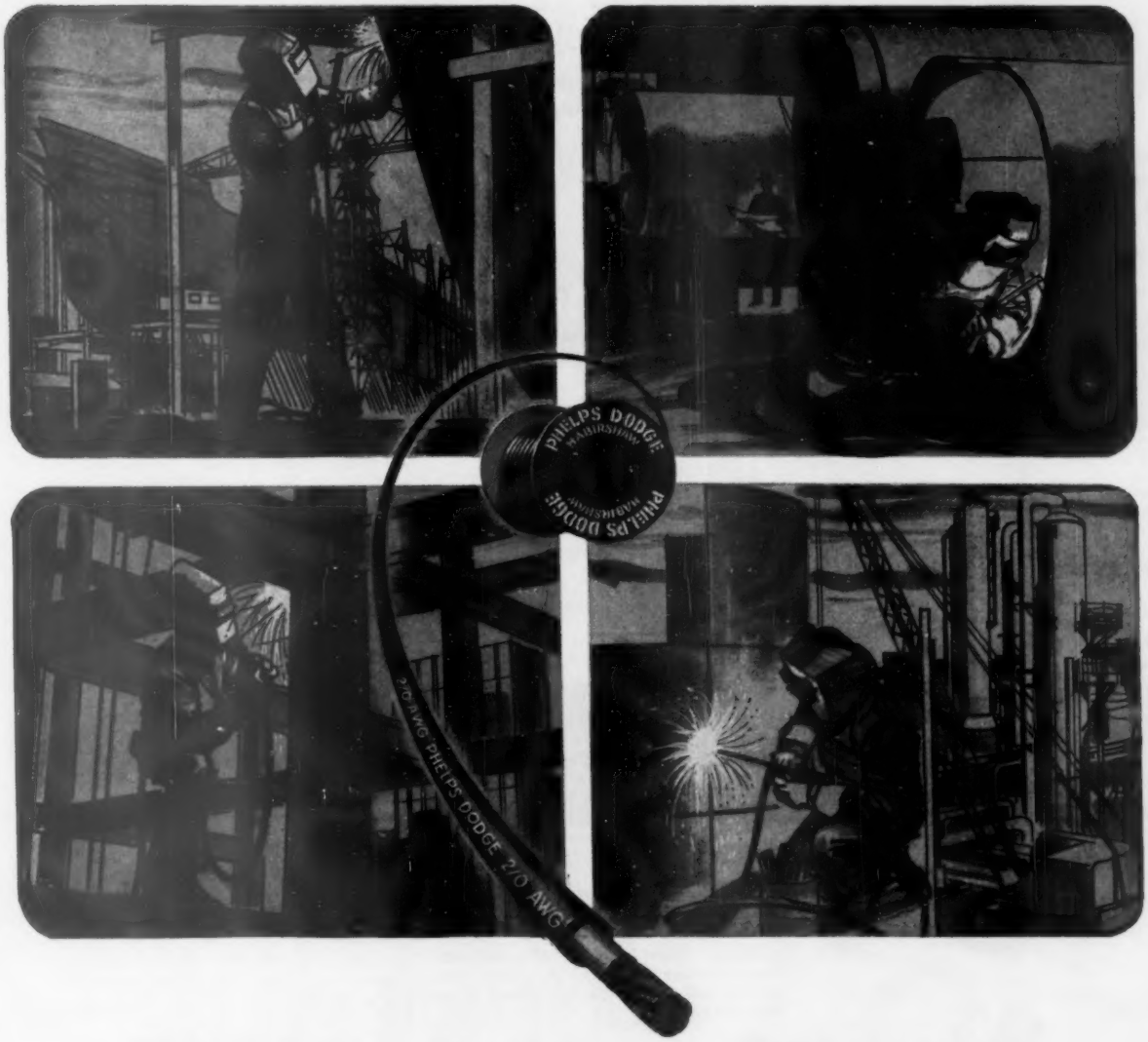

Phelps Dodge Habirprene* Arc Welding Cable
lasts longer under roughest working conditions!

The durable quality of Phelps Dodge Habirprene arc welding cable makes it ideal for use on jobs where welding cable undergoes severe physical wear and tear. Records show that Habirprene cable more readily absorbs heavy blows and weights, resists oxidation and damage caused by severe working conditions in shipyards, oil refineries, building construction and boiler-making plants. In some applications, Habirprene cable has lasted many times longer than rubber cable.

More than 10 years ago, Phelps Dodge pioneered Habirprene welding cable—the first real advance in this field. Today's Habirprene welding cable is the result of Phelps Dodge development and manufacturing experience devoted over the years to providing an arc welding cable of superior quality with a proven record for safety, dependability and long life. This cable meets all requirements of A.S.T.M. D752.

See your authorized Phelps Dodge distributor for hard-wearing, long-lasting Habirprene arc welding cable with indelible gold markings. Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All these cables are available from stock.

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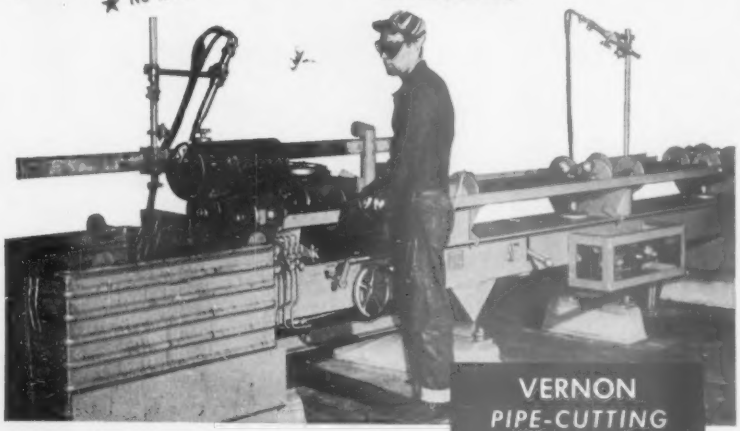

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Write for Bulletin No. P-10

VERNON TOOL CO. LTD. 1101 MERIDIAN AVE., ALHAMBRA, CALIF.

30 YEARS AGO

(Taken from **Welding Engineer** of October, 1930)

The American Welding Society awarded the Miller Memorial Medal to J. W. Owens at its national meeting in Chicago last month. He has been active in the Society since its organization.

—30 Years Ago—

E. L. Mills, sales manager of Bastian-Blessing Co., Chicago, has been elected president of the Gas Products Association, succeeding O. E. Engler of Balbach Oxygen Co., Omaha. A. J. Fausek of Modern Engineering Co., St. Louis, was named first vice president.

—30 Years Ago—

C. A. McCune has been elected to the board (and made director of research) of the newly organized Welding Engineering & Research Corp., New York. Others active in the consulting organization include Professor C. A. Adams, J. H. Deppler, J. W. Owens, Leon S. Moisseiff and A. V. deForest.

—30 Years Ago—

The Hollup Corp., Chicago, has elected W. E. Van Dreser vice president of the Eastern district, with headquarters in Brooklyn. C. L. Jones has been placed in charge of the Southeastern district, with headquarters in Atlanta.

—30 Years Ago—

Howard J. Burnish has opened an office in Milwaukee, where he will operate as a consultant to the welding industry. He was formerly with A. O. Smith Corp. and Worthington Pump & Machinery Corp.

"Don't let him kid you, Virginia. That's not the way we make a lap weld."

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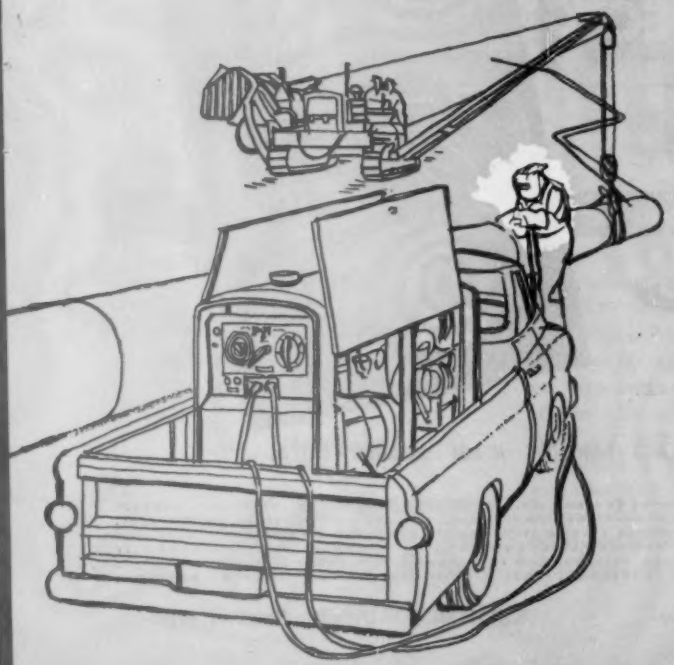
WELD 50 STORIES UP...
OR 50 MILES FROM NOWHERE

with P&H Engine-Driven Welders



You can use these portable, self-contained welders to save time and work on any construction job *anywhere!* They are ideal for buildings, pipe lines, bridges, or maintenance — wherever you need cost-cutting weld-power to join and strengthen metal parts and sections. You simply haul, wheel, or hoist the welders into position and start welding.

P&H offers you six machines for welding requirements ranging from 25 to 500 amps. Easy, precise voltage control and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts, thus sparing you the need for costly rewelds and call-backs.

You don't have to pamper P&H welders. They're built to withstand hard use and rough handling in the field. They need less care — and they are easier to service. Rugged field-proved gas or diesel engines meet your toughest demands with power and fuel to spare.

You can choose skid- or wheel-mounted machines — with manual or electric starting. Interested? Write for Bulletin W-158.

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WELDERS · ELECTRODES · POSITIONERS
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Silvaloy offers the most advanced flux developments in this specialized field. Here, is *a complete line of fluxes* . . . each providing outstanding performance, enabling you to select the correct flux for every possible low temperature brazing operation. The extra efficiency of Silvaloy "Selective Fluxing" is being proved daily on the brazing production lines of the country's leading manufacturers.

Call the Silvaloy distributor in your area for consultation and detailed information or, send for our booklet "A Complete Guide to Selective Fluxing for Low Temperature Silver Brazing."

Silvaloy fluxes are packaged in 65-lb. and 30-lb. drums, 5-lb. wide mouth jars (5 to a carton), 1-lb. and ½-lb. jars. The wide opening of the 5-lb. package makes it a most practical, time saving dispenser that also enables the operator to make use of every bit of flux in the jar.

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Between passes

report from Europe

The design lag in resistance welding equipment that until recently gave U. S. manufacturers an edge over their European counterparts no longer exists.

This view was recently expressed by F. B. Jacob and H. W. Stieglitz of Thomson Electric Welder Co., Lynn, Mass. Jacob, assistant to the president, and Stieglitz, vice president — engineering, toured manufacturing plants in six countries — Germany, Switzerland, Belgium, France, England and Scotland. They also studied welding equipment displayed at the Hanover Fair in Germany.

Their observation: **welding has become an indispensable tool in European mass production methods, and, as in the U. S., has been integrated into high volume production lines.**

The European automotive industry, enjoying increasing production demands, is particularly responsible for the quickening tempo. Plants are geared for high-speed operations . . . welding usually predominates as a low-cost, high-speed assembly method. Automated lines, becoming prominent, compensate for their labor shortage.

The long-standing European practice of accenting self-sufficiency is gradually giving way in many plants. Welding-machine makers until recently produced most components that go into a unit — gages, valves, control devices. But now the trend is toward our method of purchasing such parts, and many small plants are being established to supply them. Result: better fabrication time, quicker delivery.

Both Thomson managers said that welding of high-carbon rails is much more common in Europe than in the U. S. They encountered six manufacturers of resistance-welding equipment designed for this purpose. Paradoxically, the initial development was pioneered in this country but only recently adopted.

Currently, there is considerable interest in Europe in high-frequency resistance welding. Tube mills in particular are beginning to apply the process to welding long seams in piping and tubing, in some cases purchasing American-made generators and adapting them to European welders.

Spot and seam welding equipment are on a par with American machines in design quality and performance.

Both Jacob and Stieglitz agree that imports of resistance-welding machines do not pose a serious threat — at least for a few years. Although European manufacturing costs are about 60% of those in the U. S., ocean freight charges, duties and marketing costs erase most — if not all — of the differential.

On the other hand, U. S. companies may find it difficult to export. The advances that have been made in the past ten years dictate that U. S. machines destined for Europe have unique designs or be adaptable to new applications before their price can be justified in the European market.

wire fabric

Primarily thought of as a reinforcing agent for concrete, welded wire fabric may become instrumental in extending the life of road repairs made with asphalt.

It has become standard practice to resurface broken roads and streets with a smooth layer of bituminous material . . . at far less cost than a complete rebuilding job. But the initial economy has too often been short-lived. Under pounding traffic, cracks in the original road have tended to appear in the new covering. And worse, cracks turn into chuckholes under freezing-and-thawing conditions.

Now, the experience of those who have tested asphalt overlays reinforced with welded steel mesh indicates the answer to the chuckhole problem may lie in its use. Last year, some 50 miles of such overlay was installed in Illinois, Iowa, Texas and in Ontario.

Typical of some test results was an eight-mile stretch on U. S. Route 90 in Texas, which out-performed a non-reinforced section by 70% less cracking in six years of wear.

United States Steel Corp. cites some other reports — one from a Washington, D. C. highway department official who said that longitudinal and structural reflection cracks have been practically eliminated, and transverse reflection cracking has been reduced 60%.

How long have you been reading WE?

We are searching for a subscriber — the subscriber who has been receiving WELDING ENGINEER longer than anyone else.

In conjunction with our 40th anniversary, which will be marked with the January issue and which will be celebrated throughout 1961, we hope to give public recognition to the reader who has been our most faithful adherent.

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Simplifies joining of cast iron, bronze, brass, copper, galvanized iron, and malleable iron — or any one of these to another.

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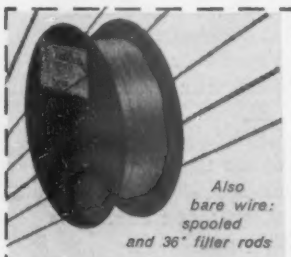

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W-157

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Harnischfeger Corp., Milwaukee: Maquinas y Herramientas Sabin St. Germain, S. A. of Mexico City.

High Voltage Engineering Corp., Burlington, Mass.: Addelco Corp., West Roxbury, Mass.

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International Ultrasonics, Inc., Rahway, N. J.: Walter T. Haas, Ltd., New York City.

A. O. Smith Corp., Milwaukee: Plains Welding Supply, Plainview, Tex.; Western Air Products Co., Lubbock, Tex.; West Texas Welders Co., Midland, Tex.; Western Oxygen Co., Odessa, Tex.; Pecos Welding Supply, Pecos, Tex.; and Western Oxygen of New Mexico, Hobbs and Roswell, N. M.

Ransome Co., Scotch Plains, N. J.: Bakers Welding Supply Co., Bakersfield and Fresno, Calif.; Weld Tooling Corp., Pittsburgh; Charles S. Freeman Co., Buffalo, N. Y.

J. B. Nottingham & Co., New York City: Nyberg Equipment Co., St. Louis.

Ampco Metal, Inc., Milwaukee: American Brass and Copper Co., Oakland, Calif.

"The man you're replacing had a tendency to be late for work, Milton."

presenting
the case
for value!
Examine the evidence—
then make your own
value judgement . . . . .
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A.C. WELDER
A. O. SMITH CORPORATION · MILWAUKEE, WISCONSIN, U. S. A.
WELDING 500 AMPERES
LOWER
RAISE

Material Evidence — NOBODY PUTS AS MUCH INTO A WELDING MACHINE AS A. O. SMITH

To prove our case — that only A. O. Smith still makes an Extra-Heavy-Duty welding machine—we've put our evidence on the table. We submit that, while other machines have been "trimmed down" to sell for less, A. O. Smith Extra-Heavy-Duty welders have all the "guts" the old-timers had. That there has been no stinting on copper, iron or power. That there has been no attempt to cut corners on materials and components—no compromise with value to meet a price.

Examine the evidence! Then make your own value analysis. We are sure that the verdict will be in favor of A. O. Smith — that it's sound judgement to pay a little more for much more machine. Analyze the value when you consider the price. It's value that pays off in longer life and superior performance.

EXHIBIT A — COILS A. O. Smith's extra-heavy copper secondary (at left) and primary (at right) coils are the heaviest in the field — together weigh 185 lbs. Note how competitive coils skimp on material. Here's heavy-duty value that adds up to longer production life . . . a machine that operates on a temperature rise of only 55°C — lowest of any machine on the market.

EXHIBIT B — CAPACITORS Standard with A. O. Smith Extra-Heavy-Duty welders is the industry's maximum power factor correction — 134 M.F.D. total. This high power factor means that the current taken from the primary line is lower than with any other machine when comparable ratings are matched — value that means money in your pocket through lower power bills.

EXHIBIT C — MOTOR Power behind the A. O. Smith extra-heavy-duty cooling system is big, totally enclosed lifetime-lubricated motor. Note "junior-size" motors used by competitive welders. Only A. O. Smith's heavy-duty motor supplies dependable starting torque . . . provides more air for cooler operation and longer machine life.

EXHIBIT D — FAN Biggest fan in the field. Air is circulated by an 18-inch industrial-type fan blade as compared to fans much smaller on other welding machines. And A. O. Smith's blade is dynamically balanced, scientifically pitched to deliver maximum ventilation down through the coils. Blast guides direct full force of the fan right on target.

COURT CALENDAR

Case for value analysis — A. O. SMITH EXTRA-HEAVY-DUTY welding machine versus the field. Exhibits shown in front row on table are principal components used in the standard A. O. Smith EXTRA-HEAVY-DUTY welding machine. Comparable components used in other well known brand welding machines are displayed in rear rows.

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Milwaukee 1, Wisconsin
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TWO NEW COMPACTS from miller

Model M-295 a-c welder

Model H-3-SR d-c welder

Wide range Miller M-295 a-c welder packs a lot of versatility in its compact 25″ x 19″ x 28″ case. What's more, it's a genuinely low-cost 40 volt 200 ampere industrial welder that doesn't pretend to be all things to all men. Rather, it offers typical Miller sturdiness and reliability in a 60% duty cycle machine that's ideal for general maintenance and light production welding. Welding amperage ranges are 25-115 and 80-295. Power factor correction available as option.

SILVER STAR MODEL

Outsized performance has been built into this "inside" welder. Designed expressly to deliver the best in d-c welding at the lowest possible cost, the brand new Miller Silver Star performs on a par with the world's best (Miller's Gold Star SRH) but is less weather-resistant. If your d-c welding is done under a roof, then you'll want to know more about the Miller Silver Star, and the economies it offers. Two sizes available: H-3-SR with amperage ranges of 40-295 and 75-450; and H-4-SR with ratings of 50-350 and 100-600.

Complete information will be sent promptly upon request. Please specify model in which you're interested.

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Model No.	Type	Delivery in cu. ft. per hr. (S. C. F. H.)	Inlet Connection CGA No.
92 AR	Argon	0-40	580
92 ARA	Argon	0-40	540
92 ARX	Argon	0-100	580
92 HE	Helium	0-125	590
92 O_2	Oxygen	0-100	540
92 CO_2	Carbon Dioxide	0-100	320
92 N_2	Nitrogen	0-100	580
92 H_2	Hydrogen	0-100	350

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OCTOBER, 1960

Welding Engineer

ESTABLISHED 1916

A little knowledge

THIS PAGE IS USUALLY DEVOTED to the promotion of, or education in, welding. And it is gratifying to learn that some of our suggestions are being accepted and put to use.

Unfortunately, there is always that man-made category in which "a little knowledge is a dangerous thing."

We want people to use welding. But recently we visited a plant where this idea was pushed to an absurd extreme. Apparently, the firm had more welding than weldors.

Thus, according to the bulletin board, anyone who wanted to become a weldor could do so in the plant's high-speed school — four hours of lecture and eight hours of practical work on a production line.

This same plant management would probably be the first to demand a check by the Better Business Bureau on a "gyp" welding school claiming to make someone a weldor in 12 hours.

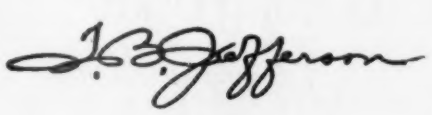
While the weldor may need educating, our biggest stumbling block is management's ignorance of welding. For example, the same management that claims to train weldors in 12 hours, tests its welds by making a single weld pass on one side of a tee-joint, then hammering the plates together from the non-welded side.

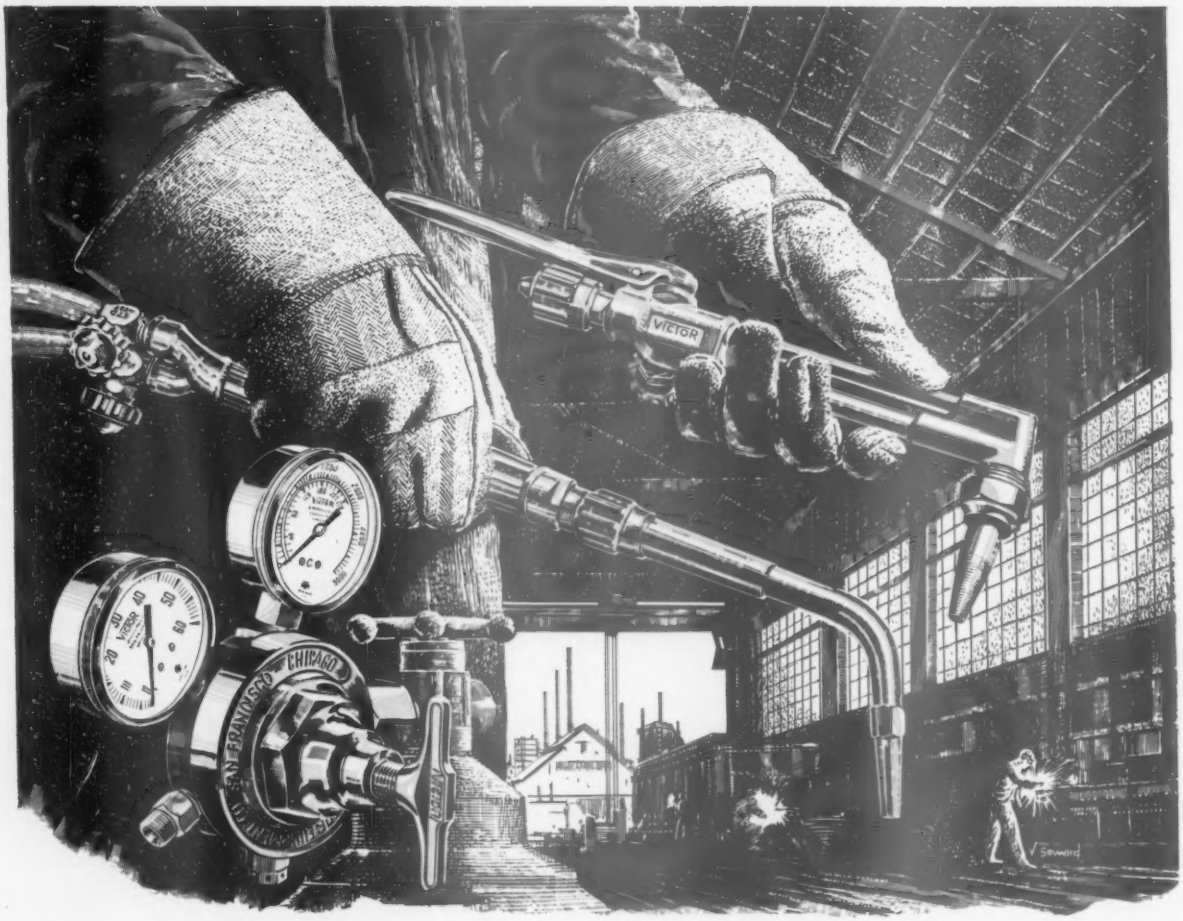
The weld breaks in the throat; their criticism: poor welding, coarse grain structure, etc.

What would happen to the grain structure if a second pass were run? Where would failure occur if they pounded the plate away from the weld rather than on it? Perhaps they should try these "tricks" and see.

Management must remember that the electrode is not always to blame. Welding technique plays an important part in successful welding operations. And while a weldor may practice some undesirable principles, his experience will always help him.

To avoid giving welding any unwarranted blackeyes, learn to do it right — and keep it that way.





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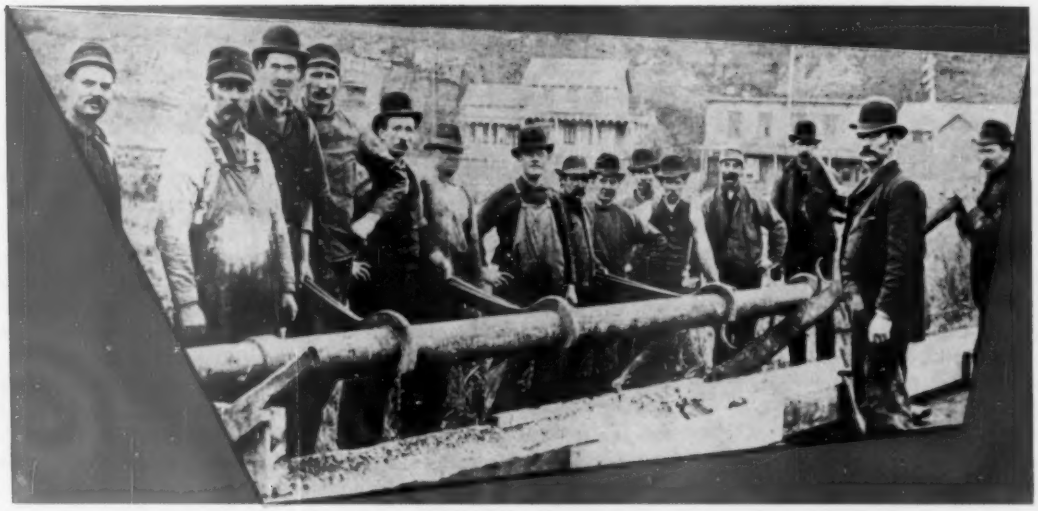


Welding and brazing in the piping industry

SINCE EARLIEST TIMES, man has been using pipe-like structures to transport his various liquids.

Turning to nature, his primary teacher, he first made use of reeds and other bamboo-like grasses to serve his piping needs. The next logical step was to fashion his own piping to suit particular jobs.

Thus, from ancient Roman times until almost 100 years ago, hollowed logs became the most common type of piping. In 1821 they were still being used in Fredonia, N. Y., to transport natural gas.

But by then cast iron piping was coming into use, and in 1862 cast iron pipe was used on a 4-mile, 2-in. line at Titusville, Pa., site of the first oil well in the United States.

However, in all these piping applications, from reed grasses to cast iron pipe, the joining of one length to another without leaks presented a major problem, one that was not solved satisfactorily until bell and spigot ends were devised.

When the spigot end was fitted into the bell,

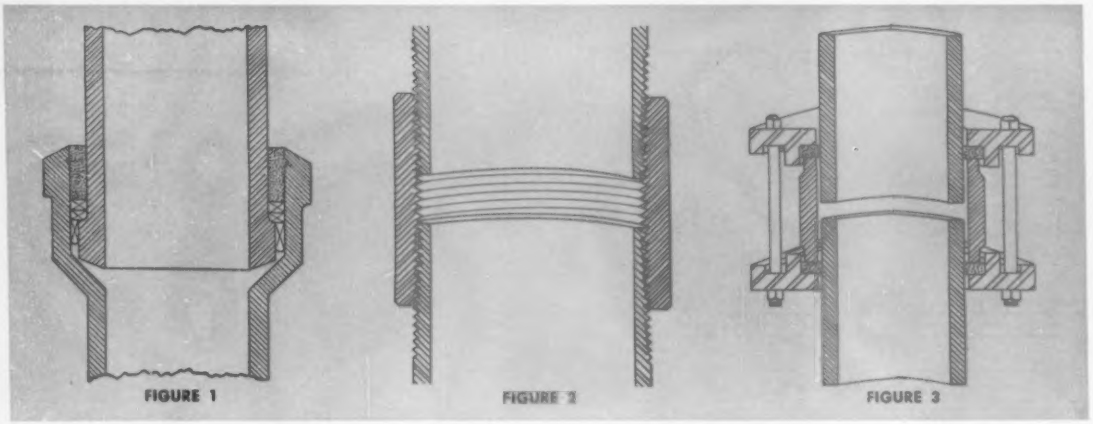


FIGURE 1 FIGURE 2 FIGURE 3

the joint was caulked tightly with oakum, then sealed off with spun or melted lead (figure 1).

This system of pipe-joining was not only water-tight, but gas-tight as well, and thus, it was satisfactory for use both on gas distribution lines and on water and drainage lines.

It is still used to join large-diameter cast iron water pipes and the sanitary cast iron piping for home and industrial use.

As wrought iron and steel pipe came into use, the threaded joint (figure 2) was developed. This type of joint can be used on any metal cheap enough to be made with heavier-than-necessary walls. From this standpoint, it lacks economy; but even so, it is the most common mechanical joint in use.

For some of the larger-diameter pipe where the threaded fitting was not practical, a compression fitting was developed (figure 3). Here cast iron, steel or transite pipes were designed to operate under comparatively low pressure and not-too-high temperatures.

Leaks were eliminated by packing or compression gaskets. These fittings were quite common in cross-country pipeline construction until the 1930s, and even today are used in some water and gas distribution lines.

However, by the mid-1930s, welding had become an important factor in cross-country pipeline operation, and most lines were joined by either oxyacetylene or arc welding.

This use of welding on pipelines spread to the construction field, so that today all pipelines are welded, as are most small diameter pipes used for heating, air-conditioning, compressed air flow lines, and water and gas distribution systems.

The welded pipe joint (figure 4) provides an efficient and economical means of joining pipes that might be used for high pressure, high or low temperatures, or in high stress applications.

Brazing alloys and the oxyacetylene flame have produced the brazed joint (figure 5) which is used extensively on copper and brass pipe tubing for plumbing, heat and air-conditioning applications, as well as many others.

The simplicity of pipe brazing has also increased its popularity for use with steel, wrought iron and stainless steel piping. And since a coupling is employed in the various joints, disassembly is relatively easy also.

This ability to take a pipe joint apart, even though it has the tightness of a welded joint, has also popularized the solder joint (figure 6). In this joint, a 50-50 solder can be melted with an oxyacetylene flame to join copper and brass pipe or water tubing.

Since it is very competitive with the threaded joint for domestic heating and drainage systems, the solder joint has almost completely replaced the mechanical joint.

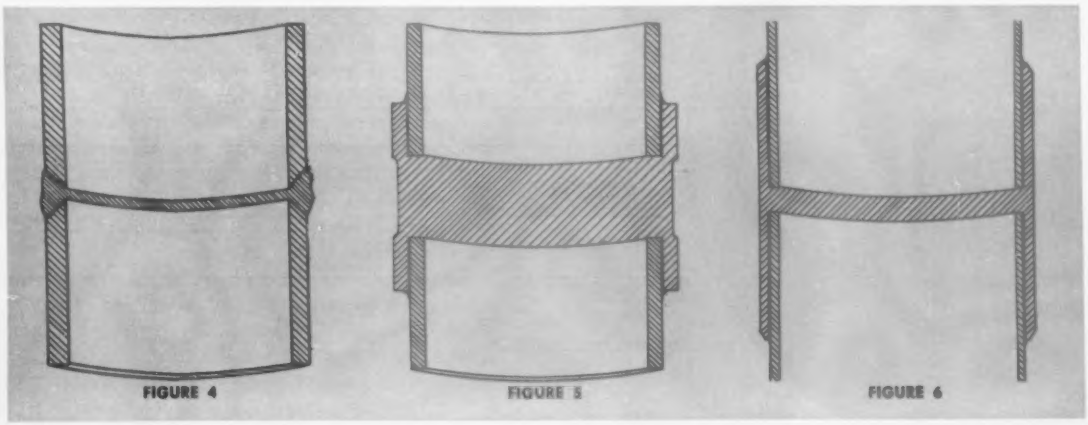
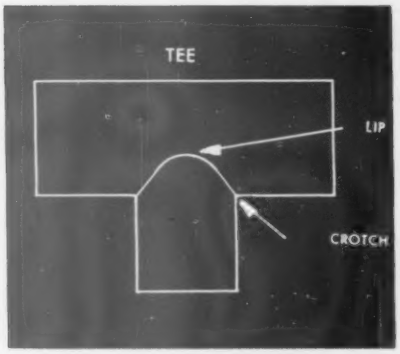


FIGURE 4 FIGURE 5 FIGURE 6



How to design tee-joints for piping

by S. A. Grubish
President, Steffan Mfg. Corp.

WELDING STRAIGHT pipe ends is relatively simple and closely follows flat-plate welding procedures. But this is not the case when pipe is joined in any manner other than end to end.

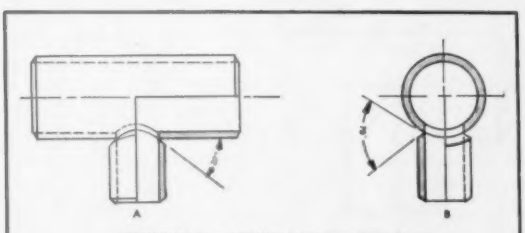
The most commonly used pipe joint is the tee-joint, as shown above in figure 1.

Although this joint looks simple, there are many factors governing its cutting and welding. (All the joints shown have a tight fit; but in actual practice the branch would be set away from the main ⅛ in. to permit full penetration of the weld.)

When the branch opening is smaller than the main, the tee-joint illustrated in figure 2 is used. Its simplicity is based on a fixed bevel angle which can be used on the contoured end to produce a welding vee around the entire pipe periphery.

This vee is not uniform in cross section. However, in average wall pipe the weldor can compensate by slowing down where the vee is wide and speeding up where it is narrow. Thus, the same number of passes will fit and crown the weld area. This particular joint is further simplified since the opening requires a straight through-hole which is a perfect circle.

The hole can be accurately cut with mechanical hole cutters which project a flame-cut circle through the curved surface of the main pipe member. Since the hole diameter is smaller than the ID of the main, no problem exists.



REDUCING TEE — OUTSIDE SADDLE — LIGHT WALL

FIGURE 2

In heavy-wall pipe the bevel angle of the contoured pipe end becomes an important welding time factor. Figure 3 (A) shows that a bevel angle of 35 deg or more must be used to provide a sufficiently wide vee-groove to obtain full weld penetration.

If this bevel angle is fixed at 37 deg around the entire periphery of the contoured end, the vee-groove will be enlarged to 74 deg at the lips (B) due to the curvature of the mating pipe.

Thus, much more weld deposit would be required at the contour lips than at the crotch.

To hold the area of the vee-groove fairly uniform around the periphery of the contoured end, a bevel must be provided which varies from a perpendicular at the lips to 37 deg or more at the crotch (C).

When wall thickness exceeds 1½ in., a reverse bevel angle is desirable at the lips as shown in (D). Proper design of heavy-wall intersections can reduce welding time as much as 50%.

Keep the size of the vee-groove as small as possible, but still allow for 100% penetration. Extra welding passes with hand slagging time between each are costly. Since a tee-joint with 2 or 3-in.-thick walls may require 40 or 50 manhours of welding, a 50% reduction in welding time is a real savings.

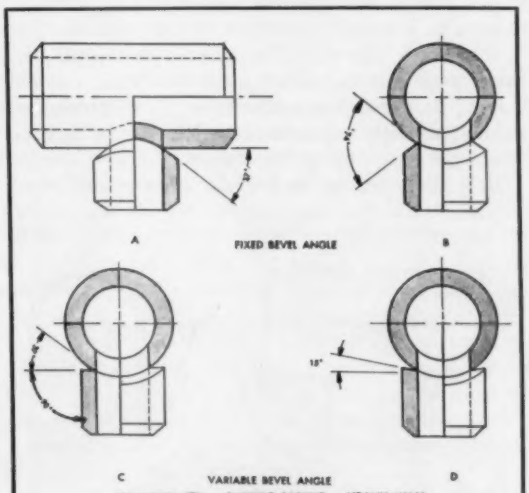
The most common tee-joint is a straight tee with all openings of equal size.

Saddling two members of identical size and wall thickness is called "saddling size on size." The geometry of such intersections varies considerably from the reducing tee of figures 2 and 3.

When wall thickness is light, as in standard wall pipe, the contoured end can be easily cut with a fixed bevel to provide a good vee-groove around the contoured end (figure 4, A and B).

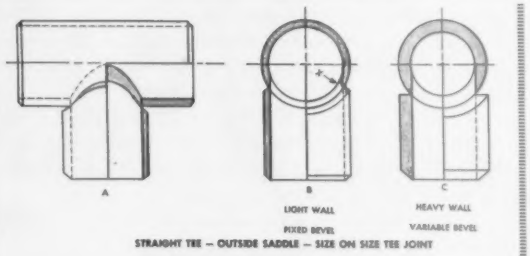
Cutting the hole, however, presents a problem since it penetrates flush with the inside surface of the main. This feature is particularly undesirable on light-wall pipe because a long feather-edge remains at the two lips.

The outside saddle joint as shown is difficult to



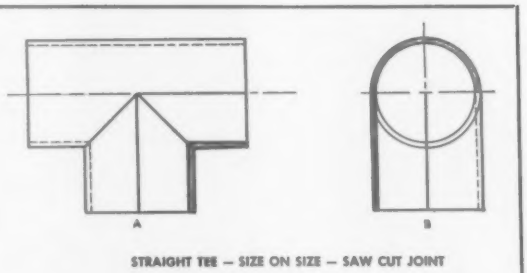
REDUCING TEE — OUTSIDE SADDLE — HEAVY WALL

FIGURE 3



STRAIGHT TEE – OUTSIDE SADDLE – SIZE ON SIZE TEE JOINT

FIGURE 4



STRAIGHT TEE – SIZE ON SIZE – SAW CUT JOINT

FIGURE 5

make for size-on-size joints. To avoid the long feather-edge at the sides of the opening, the cut can be sloped at the lips of the intersection, thus reducing the effective opening.

This slight loss is no worse than the area lost when using backup rings and presents a good solution as shown at point X in (B).

When wall thickness is heavier, the outside saddle joint can be made satisfactorily as shown in (C). Note that the heavier the wall, the less pronounced becomes the feather edge when cutting the hole.

When a variable bevel angle is used on the contoured end of heavy-wall pipe, the outside saddle is much easier to make and more satisfactory than the inside saddle as will be shown below.

The geometry for size-on-size tees for light-wall pipe is basically mitre cuts (figure 5). The end cut and hole are identical and can be made on a band saw by positioning the pipe at a 45 deg angle.

A cut made on a band saw, however, is not satisfactory except in light-wall, since the fit-up would provide no bevel for welding.

In attempting to provide some bevel angle for an inside size-on-size tee-joint, first study a fixed bevel where the angle is 45 deg to the outer surface of the pipe throughout the cut nipple and opening.

Figure 6 (A) shows that at section XX near the lips both nipple and hole are beveled at 45 deg to provide a full 90 deg welding vee. However, this vee reduces to a straight butt joint at the crotches.

The crotch, therefore, forms a 90 deg angle between mating pipe surfaces, so a fillet weld can be built up to develop strength. From lip to crotch the welding condition changes completely from a vee-type weld to a 90 deg corner fillet.

This type joint can be used for average wall pipe when pressure requirements are not great. But when wall thickness is heavier and pressure requirements greater, an attempt must be made to provide a vee-groove at the crotch to obtain weld penetration.

This can be done only by varying the bevel angle. Figure 7 (A) illustrates that in order to obtain a 30 deg vee-groove at the crotch, both pipe end and opening must be beveled at 60 deg.

A 60 deg bevel angle is difficult to make with either a machine or by hand and a uniform bevel of 60 deg would provide too wide a vee at the lips. Therefore, a variable bevel angle must be used.

The pipe end and hole must be cut at a 45 deg mitre, having a bevel angle of approximately 45 deg at the lips and 60 deg at the crotch.

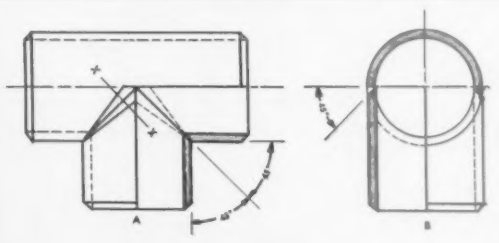
Use of the outside saddle for size-on-size tee-joints is recommended because (1) it is easier to make and costs less; (2) inside saddle penetrates to the center line of the main, reducing the main's strength and increasing distortion when the opening is made.

Many codes exist on the welding of pipe joints but little has been done to establish standard methods for preparation of pipe joints. To date, most joint preparation has been done with the hand torch and the hand disc-grinder. (For newer developments, see p. 42).

A joint design, however, is no better than the fit-up before welding. A smooth precision-cut joint properly welded will produce internal burst strengths considerably greater than anticipated.

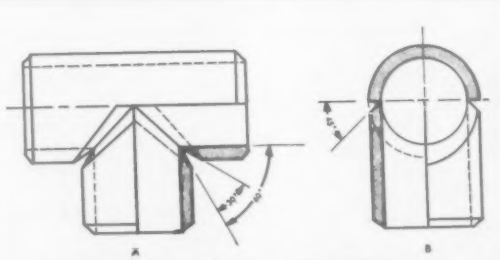
Engineers have all accepted welding of straight butt ends of pipe or fittings. But they have held back on welded saddle-connections because they doubt the ultimate strength of hand-cut fit-ups.

However, machinery is now available which provides the uniformity required to guarantee proper results.



STRAIGHT TEE – SIZE ON SIZE – FIXED BEVEL ANGLE

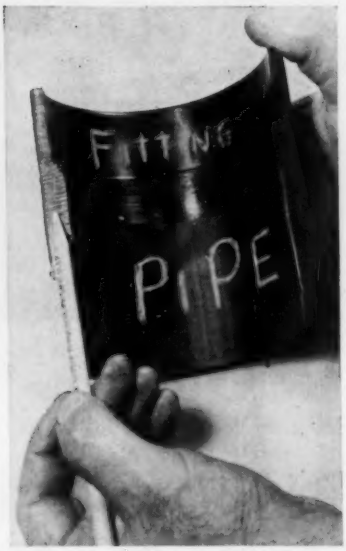
FIGURE 6



STRAIGHT TEE – SIZE ON SIZE – VARIABLE BEVEL ANGLE

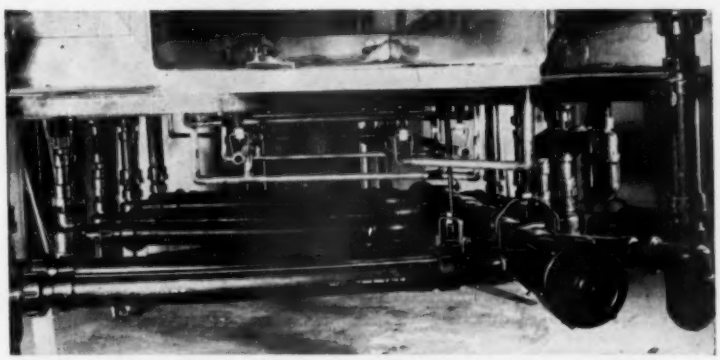
FIGURE 7

LEFT — Operator positions two plastic fittings on the heating fixture. Operation is fast and simple, requiring no special skills.



RIGHT — Cross-section of pipe joint, showing how "Polyfusion" technique has made two pieces of Vulcathene pipe into a homogeneous length. BELOW — Completed Vulcathene piping system installed in a photographic laboratory.

Plastic pipe is easily joined by torch heat



As THE PLUMBING INDUSTRY has grown, an increasing number of special metals, alloys and plastics have been utilized for every type of piping installation.

Vulcathene, a relatively new material, is a virgin polymer used by American Vulcathene Div. of the Nalge Co., Inc., Rochester, N. Y.

Light enough to float on water, the plastic pipe is unbreakable. It is relatively inexpensive and easy to install, and resists acids, corrosives, bacteria and marine growth.

Like other materials, of course, it has its limitations in a system where temperature, pressure and chemical fluids are involved. However, it has excellent application in many low pressure uses, such as waste and drainage systems for laboratories, industrial and chemical plants, research institutes, hospitals and schools, etc.

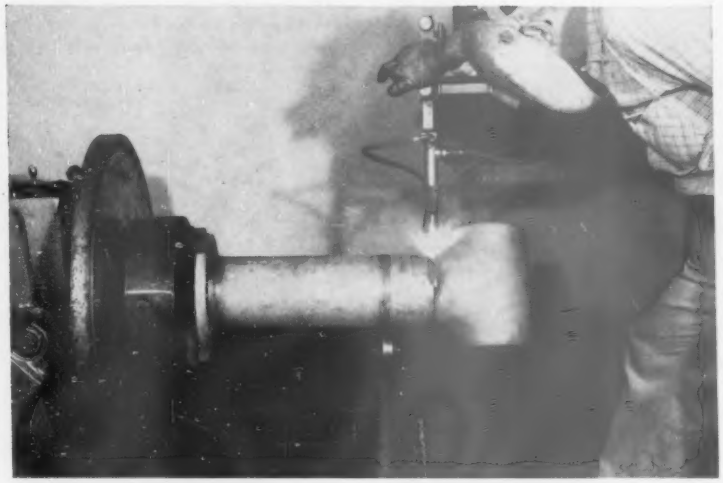
After the material was perfected, there remained the problem of finding a method of bonding joints so it could be used commercially. The "Polyfusion" process was developed in answer to this problem.

Further research demonstrated that the air-acetylene torches were ideal for heating the tools for fusion. American Vulcathene found the torches — manufactured by Linde Co., New York City — efficient and economical enough that the firm is planning to add 8-, 10-, and 12-in.-diameter pipe and fittings to its line.

While the joining tool, which incorporates the torches and specially designed sockets, is heating, the Vulcathene pipe is cut and marked for depth penetration with a china marking pencil. Next, a compression ring is placed over the socket of the fitting. Then both the fitting and the pipe end are inserted into the "Polyfusion" tool for a few seconds.

The pieces are then extracted and the melted ends are pressed together so they can amalgamate to become a homogeneous section. The entire job takes less than one minute.

Vulcathene has been used in England, Switzerland and Australia for radioactive drains and reactors.



TYPICAL set-up for roll welding pipe automatically, including stringer, or root, pass. Apparatus for Microwire process includes water-cooled torch, motor-generator power source, carbon dioxide shielding gas, automatic wire feeder and controls.

Thin-wire CO_2 process allows fully automatic roll welding of pipe

Developed only a short time ago as a method for joining light-gage mild steel, this system was quickly adapted to conquer new fields.

by *Howard B. Cary*
Hobart Bros. Co.

BECAUSE A NEW PROCESS eliminates the need for a manual stringer bead or for a backing ring, fully automatic roll welding of pipe is now feasible.

Such an automatic joining method has long been sought. The submerged-arc process has been successfully employed in shops for subassemblies and for double-ending line pipe. But a backing ring must be used — or the first pass must be made with the manual arc or Tig (tungsten inert-gas) process.

The new Hobart Microwire welding system, which employs carbon dioxide as the shielding gas, has successfully butt welded pipe, laying the stringer bead *automatically* without use of a backing ring.

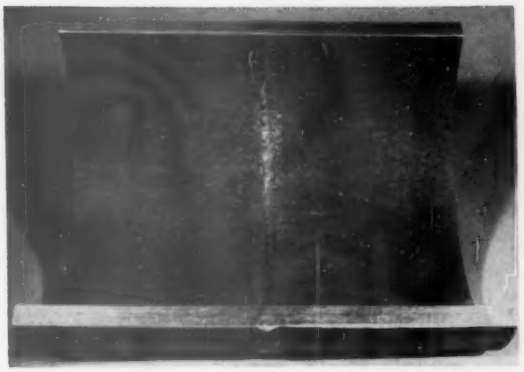
The CO_2 Mig equipment includes an automatic wire feeder coupled to a specially designed

Cost Comparison

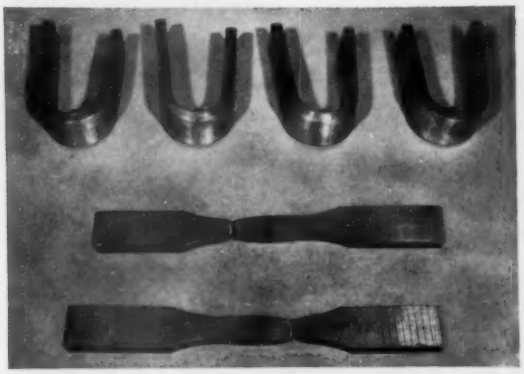
	Semiautomatic process	Manual arc
Weld time	22.20 min	43.30 min
Cleaning time	0.00 min	7.06 min
Total time	27.42 min	57.89 min
Operator factor	81%	73.4%
Labor cost @ $4 per hour	$1.83	$3.86
Electrode used	1.33 lb	2.25 lb
Electrode cost	38¢ (@ 29¢ lb)	34¢ (@ 15¢ lb)
Shielding gas	5 cu ft	none
Gas cost	5¢ (@ 1¢ lb)	none
Total labor and material	$2.26	$4.20

COMPARISON chart is based on both processes joining 8-in. diameter Schedule 80 steel pipe of ½-in. wall thickness. Pipe was welded in horizontal fixed position.

SEMIAUTOMATIC method is used here to join vertical pipe.



INSIDE view of root pass shows uniformity.



TEST bars show no surface flaws.

constant-voltage motor-generator welder. Filler wire is fed to a fixed welding torch for flat position or roll welding, or to a lightweight hand torch for semiautomatic applications.

The water-cooled torch contains the current pick-up tube and the electrode wire. It also directs the carbon dioxide shield into the welding zone, prohibiting atmospheric contamination.

The Microwire process differs from conventional CO_2 Mig methods in that an extremely small-diameter wire — usually from 0.020 in. to 0.045 in. — is the electrode used. An extremely low arc voltage — in the range of 16 to 20 volts — and a low current — from 30 to 150 amp d-c reverse polarity — are employed.

Although originally developed as a semiautomatic method for all-position joining of gage thicknesses of mild steel, the thin-wire process was soon found capable of welding carbon steel pipe in all positions.

Once it was seen that pipe was easily welded with the semiautomatic process, it was decided to try it on fully automatic roll welding — including the stringer, or root, pass.

Various combinations of root openings and root faces were tried to determine the best joint design for reproducible welds. Results of the tests showed that standard root opening and face could be employed. Also, a smaller included angle could be used, thereby reducing the amount of weld metal needed to make the joint.

For the qualification test, 8-in. Schedule 80 (½-in. wall) ASTM A-53 pipe was used. Root fusion was uniform and good, as seen in photo. No purging gas or back-up of any kind was used in making the root pass. Scale inside the pipe did not seem to affect the weld adversely, nor did misalignment (up to 1/16 in.) between sections.

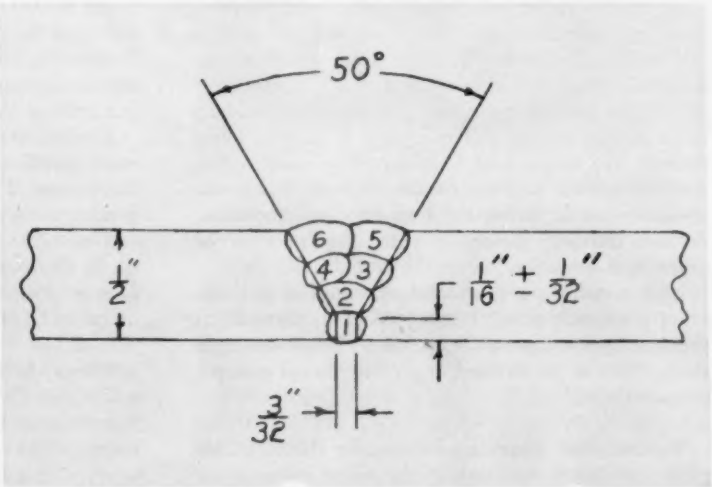
To assure quality in these welded joints, a procedure specification was qualified in accordance with Section IX of the ASME Pressure Vessel Code. Joint design is illustrated — note that bevel angles have been reduced from 37½ degrees to 25 degrees. Otherwise, the design is standard.

The electrode wire was one having a nominal composition of 13-19% carbon; 0.95-1.30% manganese; and 0.45-0.65% silicon. Test bars required by the code showed that strength of the weld exceeded that of the base metal. Bend bars did not exhibit any surface flaws and were acceptable in every way.

To further check root quality, a root bend specimen was made. In addition, X-rays were taken of the roll welded butt joints and these revealed the soundness of the metal to be very similar to that obtained with manual welding procedures.

Cleaning of welds between passes is unnecessary and was not performed during qualification tests. Surface appearance of the welds was very satisfactory.

Its flexibility makes the microwire process ideally suited to the piping industry . . . in both semi- and fully-automatic applications. Cost comparison chart on the former accompanies this article.



WELD sequence on pipe, using automatic process. Design of joint is standard, but included angle of bevel is reduced somewhat. Except for root pass at 20 volts, all passes were made a 160-amp d-c reverse polarity, 22 volts. Other weld data — welding speed: 15 ipm; wire feed speed: 340 ipm; gas flow: 25 cfh.

PIPE production begins in the mill. Here, at the A. O. Smith Corp. Milwaukee pipe mill, 40-ft lengths are longitudinally welded by resistance process, using 1,000,000 amp. After leaving welder, sections have weld beads scarfed. Pipe is then expanded to true diameter.

Pipeline operation requires coordination, trained weldors

PIPELINING, sometimes regarded as a new and rather mysterious area of transportation, has actually been a major factor in transportation of natural gas and oil products for almost a century.

Now a mass production operation, it is not unusual to find pipelining proceeding across the country at the rate of a mile or more a day.

A pipeline crew may consist of several hundred men, approximately 20% of whom will be weldors and weldors' helpers. This latter group comprises the highest type of skilled labor in a pipeline crew.

Pipeline jobs are set up so that various operations move simultaneously and in groups to prevent interference. No single area is subjected to construction disturbance for a great period of time. Lines are generally buried below the frost line and, therefore, do not interfere materially with crop planting or other farm activities.

High-pressure pipelines are built either of seamless or of plate-welded steel tubes. Most modern, high-pressure lines use a relatively thin-wall, high-strength steel, which is pre-stressed to give additional strength characteristics.

Welded steel pipe is produced by forming flat plate into tubes and joining the edges either by a resistance welding process or by automatic submerged-arc welding.

Steel used in line pipe generally has a specified maximum carbon analysis of 0.28% and a maximum manganese content of 1.25%. Specified physical properties include a minimum yield of 52,000 psi and minimum tensile strength of 66,000 psi. Elongation is specified as 20% minimum in 2 in.

Pipeline welding procedure is unique in several ways. Although welding procedure is similar on various lines being fabricated for different companies, the many variables in the field make it mandatory for each weldor to work out and qualify his own details within the structure of procedure requirements.

All pipeline welding is done by manual metal-arc welding. Automatic welding in the field has been confined to double-jointing standard sections. Downhill welding, starting at the top or side and working toward the bottom, is almost universally demanded.

Using this method, higher welding heat gives greater speed. Therefore, a greater number of beads or layers per given thickness are used. This produces a generally fine-grain structure with minimum spread of a heat-affected zone and good ductility with physical properties superior to the parent metal.

Downhill welding, because of its greater speed, is naturally more prone to defects and a high degree of skill is required to produce a clean weld. Modern pipeline welding requires radiographic quality, and this weld control is almost always specified (see p. 44).

To secure ductility in the stronger bead and greater strength in the completed weld, a combination of electrode types usually is specified. The E6010 electrode type has the ductility necessary to prevent cracking of the stringer bead and, therefore, is frequently used for this pass.

An E7010 electrode has physical properties equivalent to the parent material and is used for build-up. Frequently, an E6010 is used for capping because of its smoother appearance and because it will not create pin holes at the pipe edges.

Parallel straight beads are preferred to weaving in most specifications where a single pass will not fill the groove. The cap is usually made by weaving to produce a more finished appearance.

The welding groove has a specified included angle of 60 or 75 deg, depending on the designer's preference. For factory-beveled pipe ends, a root face or land of 1/16-in. (plus-minus 1/32-in.) is specified.

The gap between pipe ends is usually spaced "penny width" or "dime width," the usual standard of measurement in the field, with a 1/16-in. maximum spacing. The use of high-strength steel for pipeline work, with a fairly high carbon and manganese content and an ever-increasing "tramp element" content, is leading many welding engineers to preheating when temperatures approach or drop below 40 F.

All pipline weldors usually are required to take a

full-procedure weld test prior to the start of each job, regardless of previous experience or layover time since their previous job. Such procedure tests are made in the field using pipe nipples of the same material, thickness and diameter as in the pipeline under construction.

Each weldor must make a completed weld under conditions similar to the welding he will later encounter on the line. For this purpose, ends of the pipe nipples are set up so that the bottom of the test section is approximately 12 to 18-in. above the ground.

Welding speed and technique of individual weldors is recorded and kept for reference by the welding inspector. This is done so that the test weld and production welds are completed at approximately the same rate and with the same type of procedure. Of particular interest is welding heat used and thoroughness of weld cleaning.

A welding inspector is always present during the test and may disqualify a weldor on weld appearance or on manual technique even before the weld has been completed.

After completion of a visually satisfactory weld, twelve cross-section specimens are cut from the weld, three in each quadrant. One specimen in each quadrant is subjected to a pull test; one is given a nick-break test and the last one receives either a root or face-bend test.

All specimens must satisfactorily comply with specification requirements. Failure of any one specimen automatically disqualifies the weldor. Qualification of weldors by these methods usually averages 50% acceptable for any group of experienced pipeline weldors.

Apprentices, to a large degree, are trained during construction of pipelines. Each weldor is assigned a helper and most helpers are embryo weldors. After helpers have followed pipelining for some time and feel they can pass qualification requirements, they request, and are usually granted, permission to take such a test.

Actual procedure of pipeline welding in the field can best be seen by reviewing the work on a typical line "spread" laying 36-in. OD high-pressure pipe with a 0.438-in. wall thickness.

Weldors required for the spread are divided into three groups, the first including four stringer bead weldors and four hot pass weldors. The stringer bead weldors work simultaneously—each on one quarter of the weld. The hot pass men, two to each weld, work in pairs, leap-frogging each other to stay within one completed weld made by the stringer bead group.

The second group will include twenty finish weldors. Each man completes a group of three welds, then moves to the next series assigned to him. The final group of five weldors will do tie-in work and welding necessary to set valves and adjust other pipeline apparatus.

Welding machines used in the field are usually 300-amp gasoline or diesel-driven, and are mounted on tractors or movable trailers.

In assembling joints, an internal line-up clamp is used to hold joints in place so the stringer bead can be made without tack welding.

Prior to assembling the pipe, each end bevel is cleaned by power-driven buffers or grinders. Damaged ends are either refinished or cut off, depending on the amount of damage done.

Cleaning at this point is an extremely important operation and improper cleaning can mean the difference between a sound weld and a weld which is later rejected by radiographic or visual inspection.

Movement of pipe during and after the stringer bead is made, holding and operation of the lineup clamp, and resting of the pipe on wood skids after the stringer bead is completed, are also problems that can seriously affect quality and soundness of completed welds.

To prevent interference between welding groups, a gap ranging from one-half to one mile usually is maintained between hot-pass and finish-bead weldors should difficulty be encountered in the line-up operation. Gaps of greater than one mile should be avoided because of possible strains set up in the welds if they are not completed within a reasonable amount of time.

While this pipe is of weldable quality, it has become common practice to use some heating when atmospheric temperature approaches freezing. Preheat is done with a kerosene torch and temperature is held at 200 F or less.

LARGE-DIAMETER natural gas pipe is welded in field.

With the high-speed production rate of pipeline welding, inspection becomes a prime factor. Visual inspection is performed by a welding inspector and several assistants who are stationed with each welding crew.

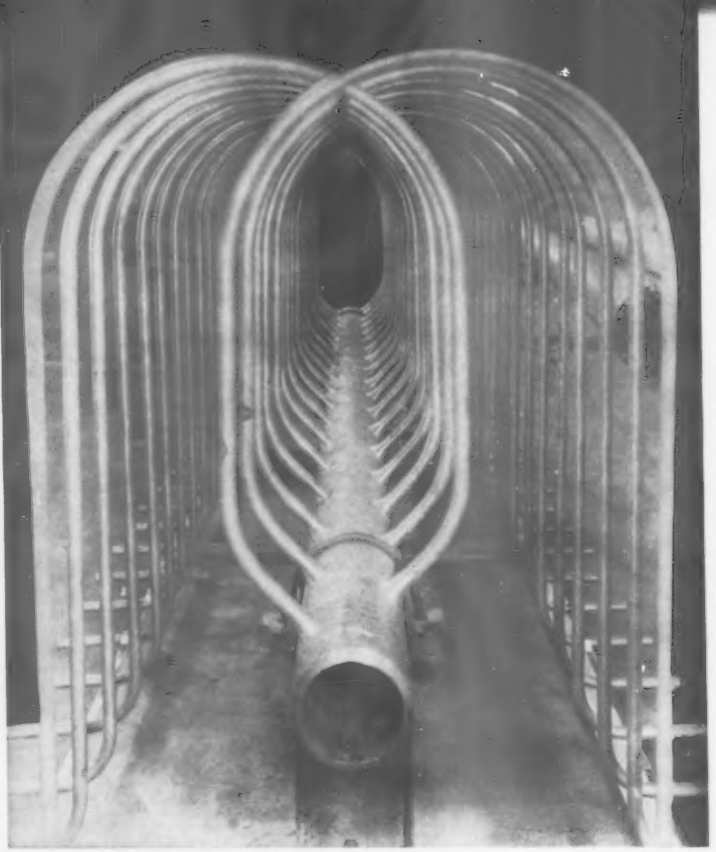
Following this inspection, a radiographic crew using an internal "pig" will examine 30 to 40% of all welds made. Welds under road crossings, railroads, rivers and through swamps are usually 100% inspected by such radiographic methods.

After a 10- to 20-mile section of pipe is completely welded, is it subjected to a hydrostatic or a gas pressure test in excess of actual operating pressure.

by F. T. Tancula

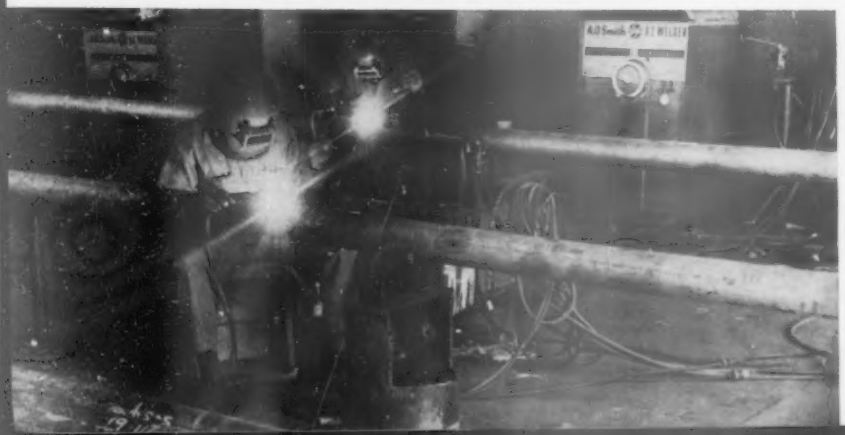
COMMERCIAL PIPING

Variety is the spice in this pipe shop's life



BELOW—Proper low-alloy preheat temperature was provided and maintained on this job by gas ring inside 36-in. diameter assembly. Pipe is ¾-in. rolled plate —1¼% chrome; ½% moly. Outlets are 18-in. 45-deg ells, Schedule 60, with ends machined to close tolerances for preplaced filler insert used in field Tig welding. Hence the metal end protectors. All welds were stress relieved and inspected by radiography or magnetic particle.

FIVE-in. Incoloy pipe, in 20-ft lengths, is welded to make 40-ft lengths. Job involved 104 center butt welds and bending 208 lengths of pipe. Tig again is the joining method. Pipe was destined for petrochemical company in Japan.



IN THE ROLL CALL of commercial pipe shops, not many can answer to the dual title of distributor-fabricator. One that can: Cornell & Underhill, Inc., of Hoboken, N. J.

Dating its origin — as a distributor — back to 1889, the firm entered the fabricating field in 1911. And today it is as well known for its own products as those of its suppliers.

Commercial piping includes a wide variety of work on both nonferrous and ferrous materials. Cornell & Underhill has a full range of equipment for welding by the manual arc, Tig (tungsten inert-gas) and Mig (metal inert-gas) and submerged-arc processes. All the firm's weldors meet the various code requirements for fabricating piping.

Bending and machining facilities complete the shop production departments.

Pictorial evidence of the variety of piping products fabricated by the company illustrates this article.

In the non-ferrous field, a recent project included the welding of a reversing exchanger piping manifold for an oxygen-producing unit. The base metal was 3003 aluminum, which contains manganese and is widely used as a general-

CONTOURED nipple is welded to header of 3003 aluminum by Tig process. Two passes completed the joint.

BELOW—Public utility called for an 18 in. Schedule 140 by 12 in. Schedule 160 forged steel 45-degree lateral. Cornell & Underhill's engineering department designed these as procurement would have taken weeks. Power source for these manual welds was a motor-generator.

purpose alloy for moderate-strength applications requiring good workability.

An oxypropane torch was used to preheat the metal before welding to 450 F. Wall thickness is ⅜ in. (Oxygen is supplied to the shop through permanent piping from a 128-cylinder bank. Work sites are furnished with individual propane tanks.)

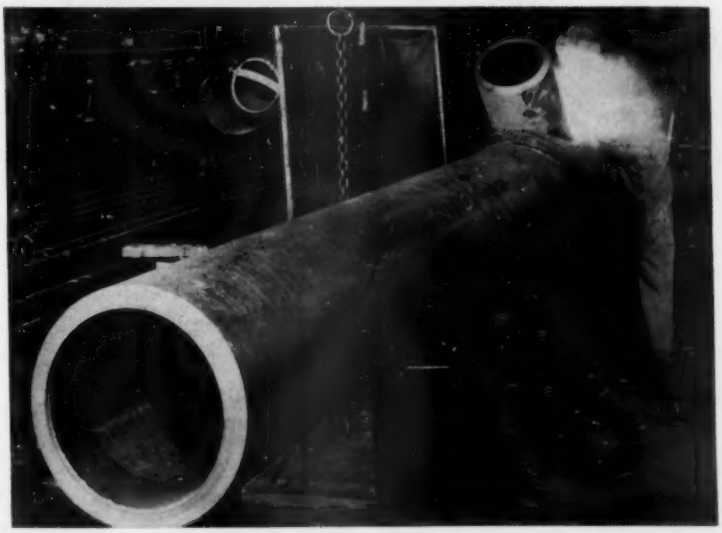
Where butt welds were to be made on this aluminum manifold, edges were beveled 37½ degrees (75-degree included angle) down to a feather edge. Joints were made in two passes by manual Tig welding, using 1100 aluminum, a soft alloy, as filler. A Tec torch was employed.

On the first pass, filler wire diameter was 1/8 in.; on the second pass, it was 3/16.

Nozzle welds, which joined a contoured nipple to the header-type main assembly, were also made in two passes, using 200-amp current off a 400-amp welder.

These shaped nipples were beveled 45 degrees and contoured on a mechanical saw prior to welding. Flanges, 1¼ in. thick, were joined by fillets to both the OD and ID.

Shielding medium was argon gas, consumed at a rate of 25 cfh.



ONE of three 3-section multi-alloy furnace heater coils for an intricate petroleum process involving four widely varying heat zones. Each three section coil was composed of four different kinds of 4-in. pipe — carbon steel; chrome-moly; type 304 stainless and Incoloy. Welding involved both similar and dissimilar metals.

Pipe layout, preparation can be easy —with the proper tools

FIG. 2 — A portable beveling machine can be used in shop or field.

PROPER LAYOUT of various types of joints is one of the biggest problems in pipe welding.

Offsets, bends, reducers and similiar layouts are frequently required to install welded piping in its proper location. Fortunately for the weldor, various aids have been developed to simplify his welding problem.

Welding fittings such as elbows, tees and reducers, are often helpful in pipe welding. However, since these cannot solve all problems, the weldor must still know how to layout a pipe joint.

Templates have been developed which make layout practically foolproof, that is, if the proper template for the required joint and pipe size is available. And a skilled weldor can layout a pipe joint with nothing more than his belt or some other "roundabout."

Another of the simpler means is the mechanical marker made by Contour Sales Corp. and shown in figure 1. When used with a centering head, it provides a ready solution to all layout problems.

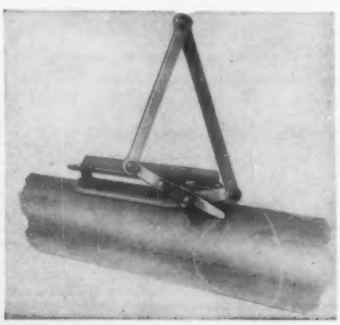


FIG. 1 — The contour marker makes pipe joint layout an easy matter.

After the joint has been laid out, however, the weldor must still obtain the desired contoured pipe end, either by manual or automatic flame-cutting, sawing or shearing. On a flame-cut joint, accuracy is greatly improved by using either portable or stationary beveling and cutting machines.

Portable beveling machines (an example is shown in figure 2) are manufactured by H & M Pipe Beveling Machine Co., C. A. Mathey Machine Works, Inc., and M. J. Crose Mfg. Co. They are available in many different sizes for use on pipe ranging from 1½ to 36-in. OD.

These machines are designed to cut from zero to a maximum 45 deg bevel. "Out-of-round" attachments are available for use on round or "egg-shaped" pipe ends, as are shape-cutting attachments for nipples with contoured ends. This latter attachment is a cam which develops a "template method" (figure 3).

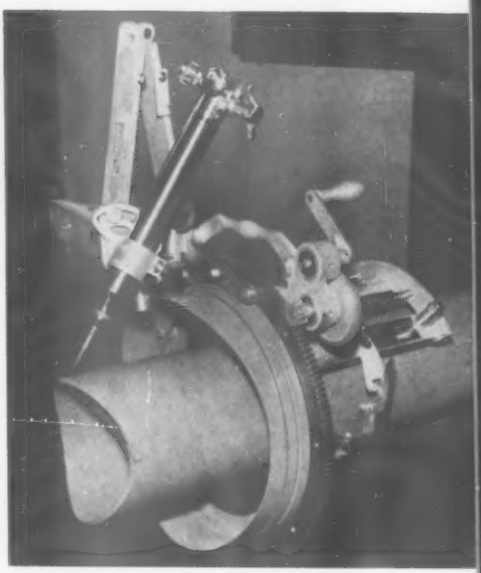


FIG. 3 — With a shape-cutting attachment the beveling machine contours pipe ends.

FIG. 4 — This shop-located flame-cutter uses a cam to obtain contoured cuts.

One of the larger stationary machines is Vernon Tool Co. Ltd.'s 20-ft-long pantograph shown in figure 4. The two torches can produce almost any contour or hole in piping up to 24-in. OD. In operation, the near torch can be locked

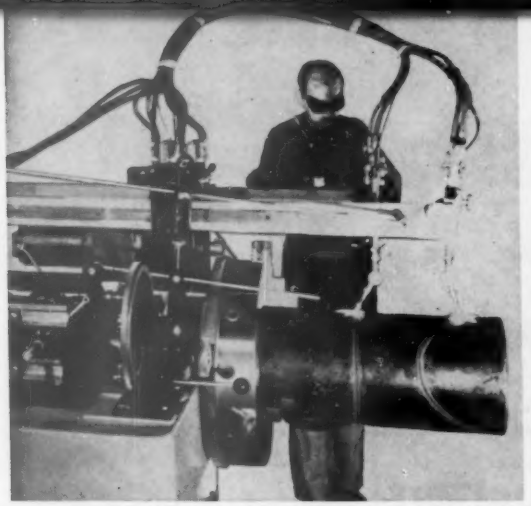


FIG. 5 — Two 16-in. fishmouth nipples are cut simultaneously on this machine without aid of cams, templates or layouts.

FIG. 6 — Protractor head and special chart are keys to good fit-up when using this cut-off saw.

in position to make straight cut-offs at any desired angle while the pipe is rotated by turning rolls.

For more complicated intersections (mitre, tee, offset) the proper cam is selected from the manufacturer's chart and fastened in place by two cap screws turned finger-tight. Gear-timed to revolve once per pipe revolution, the cam pushes a follower which moves the torch longitudinally.

The hole-cutting or rear torch can be set and locked to cut a hole of any desired radius, and is rotated by a spline shaft which moves up and down by means of a cam to follow the header contour.

Thus, the accurately prepared parts produced make possible quicker fitups, giving machine accuracy to the welded groove and keeping the amount of weld metal required to a minimum.

Another of the larger machines is Steffan Mfg. Corp.'s automatic contour cutter, which can generate a curve of intersection for two joining cylinders without any man-made layouts, cams or templates.

Only four simple adjustments are required to change from one type of joint to a completely different one. Yet it is claimed that these settings can be made in 30 seconds or less and eliminate all need for pipe layout before cutting.

The two torches operate simultaneously as shown in figure 5, and will produce a complete piece with ends beveled in the opposite direction during every cycle. The machine can also produce a large number of similar or completely different pieces every few minutes.

One of the most recent developments in mechanical pipe cutting is the DeWitt system which uses a standard cut-off saw with a special protractor head, manufactured by Wallace Supplies Mfg. Co.

The unit is a table vise fixture which can be rotated through a plane at right angles to the cutting wheel path, and at the same time, if necessary, be shifted horizontally (figure 6).

Thus, the operator reads settings from a copyrighted chart so that coordination of settings in the three cutting operations will produce a tube end requiring no more preparation prior to welding.

With either an abrasive disc or metal saw as the cut-off wheel, this device will produce laterals for any angle between 35 and 90 deg.

Another device for producing laterals in such degrees is Vogel Tool & Die Corp.'s arc notcher. Using a punch and die fitted in a punch press, tubular ends are sheared clean with a true contour and minimum burr and distortion (figure 7).

Various die sets are available to accommodate pipe and tubing from ½ to 2⅜ in. OD.

Still another comparatively new development, particularly suited for heavier gage pipe, is the H & M bevel-land grinder. With this machine a flame-cut beveled joint can be quickly cleaned to insure the desired bevel, after which a simple adjustment makes it possible to grind a true land on the pipe end (figure 8).

All these tools mentioned above, and all other similar tools, not only help the weldor to do a better pipe welding job, but at the same time increase the accuracy of his finished products.

FIG. 7 — A variety of end contours are possible with this punch and die unit.

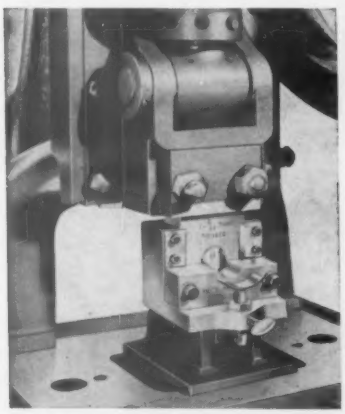
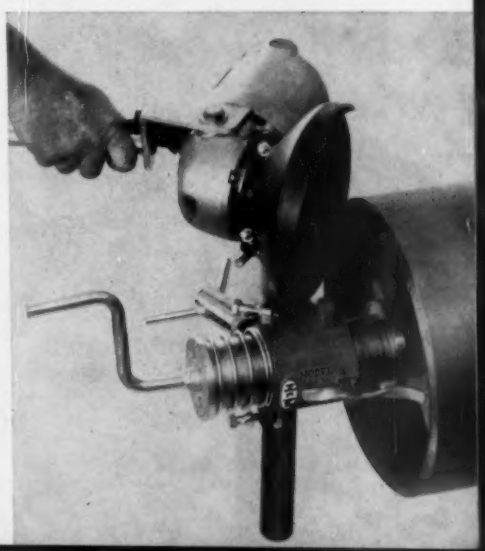


FIG. 8 — After cleaning the bevel, the grinder is swung around to make a true land.



How to use RADIOGRAPHY in pipeline construction

by J. R. Strebelle*

BECAUSE OF THE INHERENT difficulties of pipeline welding in the field, welding defects in varying degrees of seriousness can always be expected.

And each particular case will require special study as to the nature and magnitude of defects which can be tolerated. A second consideration is the amount of inspection needed for a specified degree of safety.

When the principle of inspection has been accepted, the means of inspection must then be chosen. Currently, radiography is the most widely used non-destructive testing method for pipelines.

(Although ultrasonic testing is also being used and shows promise, it has not reached a point where it can be used as a routine method, [see p. 62]. Magnetic participle inspection has also been used, but since it points out only superficial or shallow-depth defects, information is limited.)

Since radiography gives the most accurate description of weld defects, it is used in the majority of cases. However, a choice still must be made between X-ray or gamma ray source, depending on which is the most practical and economical solution for a particular inspection application.

Placement of the radiation source at the center of a circular welded seam with the film located on the outside is the ideal radiography method (figure 1).

Thus, the weld is irradiated in a single exposure, the radiation falling perpendicularly on the film surface with the distance between source and film being the same as the pipe radius.

Except in large-diameter pipes (28 in. or more), it is difficult to use X-ray equipment because of space requirements; a radioactive source is far more suitable because of its easy manageability.

However, it is usually not possible for a man to enter the pipe to place the radiation source at the weld's circumferential center. One solution would be a radioactive source on a rod, but in field applications it is best to keep such complications at a minimum.

An easier, more logical solution is to drill a small (about 3/8-in.-diameter) hole in the pipe wall approximately 4 in. from the joint to be radiographed.

The radioactive source is then introduced through this opening which is manual metal-arc welded after radiography is completed. Small travellers carrying the radioactive source have also been used, but the required tube-cable setup limits its acceptability.

Although the radiation source in the weld's circumferential center is ideal, it is also possible to obtain radiographs with the source on the outside. In this "double-wall" technique, the source is placed against the outside of the pipe with the film directly opposite.

Thus, radiation passes through the pipe's thickness twice (figure 2). One disadvantage is the increased exposure time required; a second is the impossibility of radiographing an entire joint in one operation.

To obtain an efficient radiograph, the circular joint must be

Mr. Strebelle is department head of Association des Industriels de Belgique. Material for the article courtesy of The Gevaert Co. of America, Inc., New York City.

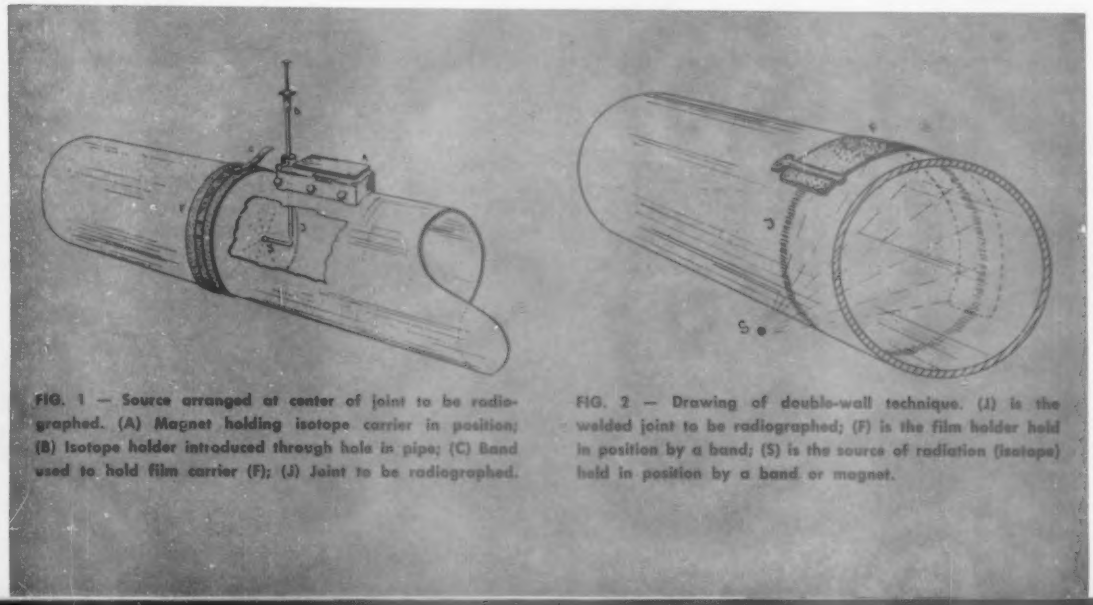


FIG. 1 — Source arranged at center of joint to be radiographed. (A) Magnet holding isotope carrier in position; (B) Isotope holder introduced through hole in pipe; (C) Band used to hold film carrier (F); (J) Joint to be radiographed.

FIG. 2 — Drawing of double-wall technique. (J) is the welded joint to be radiographed; (F) is the film holder held in position by a band; (S) is the source of radiation (isotope) held in position by a band or magnet.

YOU CAN'T ALWAYS WELD BY THE BOOK

Books don't pinpoint all the welding variables. Complex joints. Fussy metals. Tricky fixturing. These variables create problems, more and more of which are being solved by the utilization of *inert-gas* and *consumable-electrode* welding processes . . . combined with pioneering *experience*—the kind you find at Linde Company's Electric Welding Laboratory. Everyone claims "unmatched" research and development facilities. We have 74 fully-equipped *electric welding* stations . . . 100-plus *electric welding* specialists who spend 62% of their time on customers' problems, much of it in customers' plants, all of it free-of-charge. We are spending 3.5 million dollars every year to develop new processes, improve existing ones, and support customer-assistance programs. Here, in the past 25 years, LINDE has developed eleven major inert-gas and consumable-electrode concepts—from *submerged-arc* to *short-arc* —far more than any other manufacturer. The source of these developments—the LINDE Electric Welding Laboratory—is always ready to work for you. And since we market *every type* of inert-gas and consumable-electrode equipment, your problem receives the authoritative, yet impartial study you need.

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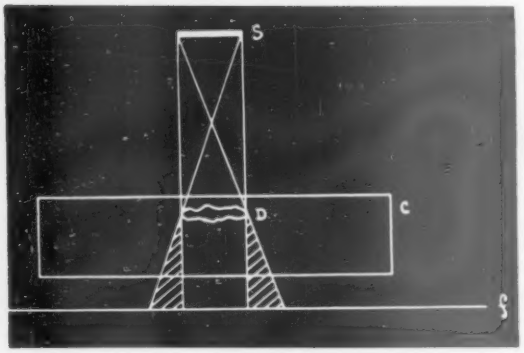

FIG. 3 — Geometrical penumbra effect. (S) Source of radiation; (C) Body to be radiographed including defect (D); (F) is film. Shaded area is penumbra zone which detracts from clarity and contrast.

irradiated one-third of its circumference at a time (in halves if absolutely necessary and if an inch or two of non-irradiated joint is allowable).

Although total inspection time is longer for the double-wall technique than for the centered-radiation method, it does not require the extensive setup of hole drilling and welding. On an actual field worksite, this one advantage counter-balances the disadvantages; hence, its wide acceptance.

The disadvantage of increased exposure time is further lessened since more active (larger) radiation sources can be utilized.

A radiograph is the result of the projection onto a plane (film) of a three dimensional body (weld) starting from a point (radiation source). Thus, the weld defect is projected on the film in a conical shape, the apex of which is the radiation source.

However, since the source is not a single point, the defect's contour on the film is accompanied by a zone of penumbra which detracts from image clarity (figure 3). Depending on the degree of radiographic fineness required, a certain amount of unavoidable penumbra can be tolerated.

Width of the penumbra zone can be reduced (1) by increasing the distance between source and object to be inspected; or (2) by reducing source dimensions.

If the distance chosen is twice as great, the source may also have linear dimensions which are twice as great for the same penumbra; thus the source can have an eight times greater activity.

For this reason, the double-wall technique can use radiation sources twice as large (*i.e.*, eight times as active) as in the centered radiation method.

These inspection methods are all based on the use of radioisotopes. X-radiation is not considered because, except in rare exceptions, the X-ray tube has a fixed focus dimension of a few millimeters, making it impossible to get closer to the object to be radiographed.

Nevertheless, X-rays generally have the advantage of a considerable saving in exposure time as compared with radioisotopes. But the advantage is not really a determining factor since it is easier to have one operator use several radioactive sources simultaneously than several X-ray units which require electric current.

However, the latter are used to advantage for examining large diameter pipes where distance between film and source would require high-activity isotopes necessitating containers as heavy and cumbersome as the modern X-ray tube.

Besides this consideration of inspection convenience, image quality must be considered.

Radiographs obtained with X-rays are (for thicknesses usually used in pipelines) always better, if only slightly, than those obtained using isotopes.

However, the real question is if radiographs taken with isotopes are good enough to detect all non-tolerable defects. There is no longer any doubt that results obtained with isotopes are adequate.

By means of wire image quality indicators, it is possible to record as much as 2.5% using isotopes. With double-wall techniques, the thickness through which the radiation passes is greater and results are slightly less satisfactory.

(A sensitivity of 2.5% shown by a wire image quality indicator means that the image of a wire having a diameter equal to 2.5% of the object's thickness and placed on the latter during inspection is visibly recorded.)

Satisfactory results, of course, can be obtained only by conforming to the proper principles of radiography, *e.g.*, using fine-grain, high-contrast film; correctly stopping down the beam of gamma rays to reduce harmful diffusion; using lead intensifying and anti-diffusing screens.

When using wide-spectrum isotopes, particularly iridium, it is best to filter the radiation as it leaves the source by means of about half a millimeter of lead to narrow the radiation spectrum emitted.

The isotope most generally used for pipeline is iridium 192, which is similar to an X-ray tube operating at 400 kw. These sources generally have a diameter and length of 4 mm, and sometimes 2 mm. The 4 mm sources have an average activity of 2 to 3 curies and make it possible to obtain normal radiographs at exposures of 5 to 10 minutes.

However, since iridium has a half-life of 75 days, cesium 137 has generally replaced it. There is no question of using cobalt 60. The results obtained with cesium are not quite as fine as those of iridium, but its advantage is its half-life of 33 years, making it more or less constant.

Radiographic inspection of welded pipe joints is an absolutely indispensible operation for on-site welding. The next step is to estimate what percentage of the joints should be inspected so as to obtain the maximum degree of safety for the pipeline as a whole.

If conducted in this manner, pipeline joint inspection can be an extremely economical operation; the cost not exceeding a few tenths of one percent of the entire cost of the pipeline.

JOINT being stressed relieved connects 24-in. chrome-steel pipe of ⅞-in. wall thickness to check valve with 3-in. wall. In practice, another piece of asbestos insulation was placed over valve but was removed so photo could be taken.

Localized stress relief of pipe is simplified

by Gerald Scott
Hobart Bros. Co.

LOCALIZED STRESS RELIEVING of welded pipe joints in the field often has been considered impractical. The primary reason: a procedure with too little control, involving too much time and too much work by trial and error.

This view has been stimulated by the notions that equipment was difficult to control, was extremely heavy, and required proximity to the joint. Simplified procedures have now eliminated these and other objections.

However, no method of stress relief can reduce actual time needed in the heating-soaking-cooling cycle. This factor is determined by the post-weld treatment required by the specific steel used in the pipe, and by the end results desired of the stress-relieving procedure.

Nevertheless, some savings in total time can be made by:

(a) performing the operation correctly the first time;

(b) eliminating failures in coil construction;

(c) reducing the handling of equipment between jobs;

(d) simplifying operation of the equipment to eliminate human errors by automating the process;

(e) providing coils that can be easily handled and that can be used in confined areas (which would mean elimination of bulky water-cooled coils);

(f) having a better knowledge of requirements and procedures for stress relieving.

A case in point: In a new addition to a large power plant, one of the many joints requiring stress relief was a weld connecting a 24-in. diameter, 1¼% chrome-steel pipe (⅞-in. wall) to a check valve having a 3-in. wall thickness.

Stress requirements: Elevate the temperature at a rate of 250 F per hour to 1,300 F—plus or minus 25 F; soak at this temperature for two-and-a-half hours; cool at the rate of 250 F per hour down to 600 F; then cool under wraps to the ambient temperature.

Time required for actual procedure: nine hours.

Additional time required for preparing the joint once the weld was completed (which included attaching thermocouple, insulating joint, wrapping induction coils, making electrical connections): two hours.

Equipment included a Hobart 50-kw induction heating generator driven by a three-phase 75-hp motor. This provided a balanced load across a three-phase power source with a maximum input into the motor of 91 amp at 440 volts, thus eliminating need for special power lines.

A fully automatic control system consists of a strip-chart type recorder providing a continuous temperature recording line, a heating-rate controller, a soak timer and a cooling-rate controller. A proportional-type control system automatically adjusts output of the generator to provide the correct amount of power into the induction coil to produce the exact amount of heat required at any phase of the stress-relief program.

Once the desired program is set on the dials and the unit is turned on, no further adjustment by the operator is necessary. The 400-cycle generator has condensers connected across its output to provide power factor correction between the highly inductive load and the generator itself. Only generator requirements are reflected to the motor . . . not the normal low-power factor load of the induction coil.

The 400-cycle system permits use of small diameter wire for the coil (normally, No. 3 wire is large enough for any job). And because of the low currents involved, cables between generator and induction coil are no larger than ordinary welding cables. The generator can also operate at a considerable distance from the work. (In the job described here, the generator was located about 100 ft from the work.)

Attachment of the thermocouple can be a critical part of the procedure. One commonly used but incorrect system: bringing the thermocouple out from the weld joint at right angles to the pipe.

This promotes the possibility of having the hot junction point of the thermocouple in poor physical contact with the area to be heated and permits its chilling in the exposed area. Result: a temperature indication considerably below actual temperature of the joint.

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Manufacturers recommend that at least 8 in. of the thermocouple be exposed to the heated area. In the power plant job, the end of the thermocouple was inserted into a steel tube approximately 1 in. long. The tube was compressed tightly to the thermocouple, then welded to the joint with thermocouple parallel to the pipe.

(Care must be taken so that no deposited weld metal will come in contact with the thermocouple itself.)

Weldor's grade asbestos paper was used as insulation, with several layers placed around the pipe and over the outside of the thermocouple to a thickness of about ¾ in. The insulation was extended approximately 18 in. on each side of the joint and was fitted around the valve body as closely as possible.

(To get an even and low temperature gradient at each side of the heated band, you must extend the insulation beyond the coil width.)

The coil was placed over the outside of the insulation and actually consisted of two coils of No. 3 copper wire connected in parallel. On the pipe side of the joint, the coil consisted of 16 turns; on the valve side, 15 turns. Since the valve was larger in diameter, this gave a uniform loading to the two coils.

Heat loss is the major problem in stress relieving, so a piece of asbestos was placed over the top of the valve to reduce radiation losses. (This cover not shown in photo.)

Currents involved in this operation: a maximum of 387 amp in the coil — 200 in the valve side, 187 in the pipe side — while generator current was 230 amp. The difference was due to the power-factor correction provided at the generator, as noted above.

Whether the joint be 6 in. or 24 in. in diameter, the automatic control system will assure the same degree of accuracy in providing the desired stress relief program without any adjustment by the operator. Generator output will be governed to provide the exact amount of power required.

Coil construction will vary according to pipe diameter, but it is all in tabulated form which can be readily applied to any job.

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PHOTO 1 — Flexibility through good fixturing is necessary where production volume consists of a variety of assemblies.

Power piping costs lowered by automatic submerged-arc welding

by R. A. Wilson
Vice President
The Lincoln Electric Co.

FACED WITH RIGID QUALITY requirements and rising labor costs, piping fabricators are turning to fully-automatic submerged-arc welding to maintain a competitive position for their products.

Although applications chiefly involve 4 to 10-in.-diameter pipe, typical installations can be readily modified to handle diameters from 3 to 50 in., if production volume justifies it.

Welding speeds up to four times that of manual arc welding are normal on most applications. Considerably higher current settings provide high deposition rates as well as heavier deposits, thus frequently reducing the number of passes required to complete a weld.

Installations for automatic submerged-arc welding can be extremely simple or complex, depending on production requirements.

Where production is diversified, the installation shown in photo 1 for fabricating power plant and industrial piping of all kinds is most practical. Here a fully-automatic head is mounted on a boom-type welding manipulator and remains in a fixed position while the work is rotated by powered rolls.

For the shop where production volume cannot justify the capital expenditure necessary for a fully-automatic installation, maximum simplicity and economy is found in the equipment shown in photos 2 and 3. The work in photo 2 is automated by a variable speed positioner with sufficient capacity.

A semiautomatic squirt welder is used to deposit the weld metal. The gun is flexibly supported to permit movement during welding and can be easily adapted to the variety of assemblies produced.

The fixture in photo 3 mechanizes the semiautomatic squirt welder for internal longitudinal seams on larger diameter pipe as seen in the background. In this case, the work remains stationary while the gun traverses the joint.

Recent developments hold great promise, but have not as yet proven completely practical for all aspects of pipe welding. Inert-gas shielding and inert-gas flux shielding processes have both had successful applications.

Another development involves all fluxing ingredients being placed in the electrode (wire) core, and has great possibilities. Thus, the ingredients produce a vapor shield eliminating the need for gas or flux shielding.

No doubt areas will be found where these methods will be used to advantage. At present, however, welds produced by submerged-arc welding are still the most practical and economical.

PHOTO 2 — Deep penetration and compact design of semiautomatic submerged-arc welder provides economical 100% penetration on this assembly. Flexible mounting adjusts vertically or laterally to follow the joint while welding.

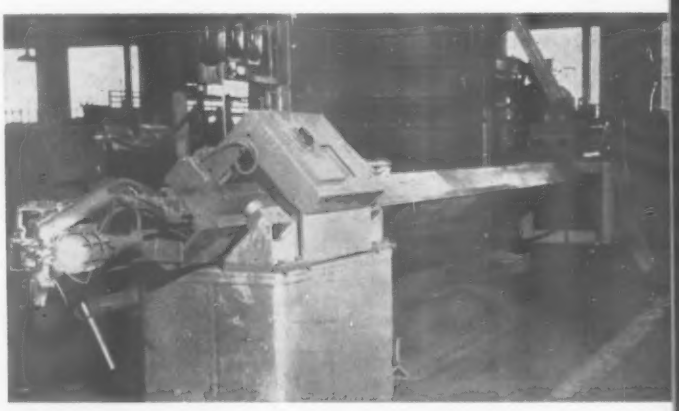

PHOTO 3 — Semiautomatic squirt welder mounted on boom-type fixture provides low-cost, fully-automatic submerged-arc welding for longitudinal welds on large-diameter, non-standard pipe. Unit will fabricate pipe up to 18-ft long.

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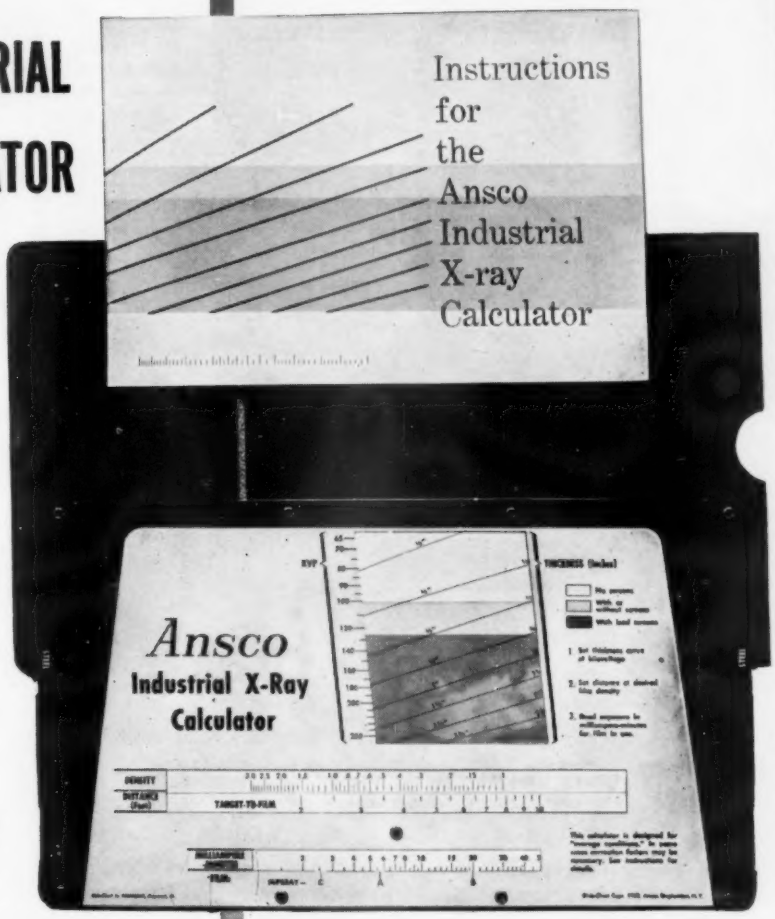

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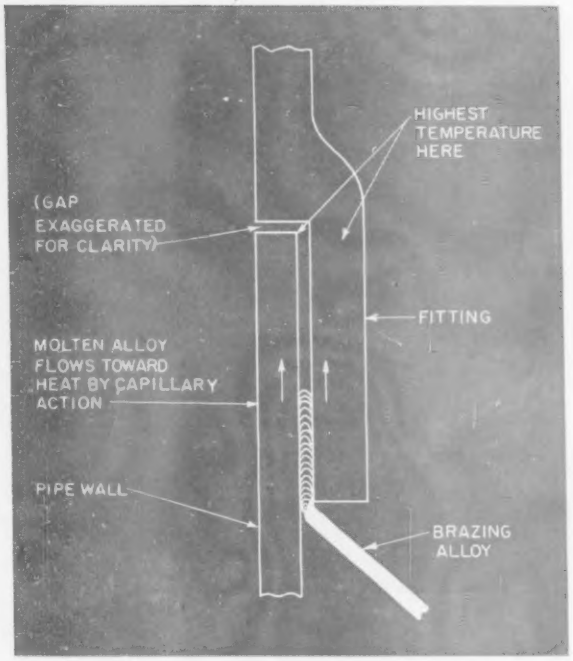

FLOW of molten silver brazing alloy is toward heat so that with proper torch handling the alloy can be drawn into the full depth of the cup regardless of its position.

by Alden W. Swift
Handy & Harman
New York, N. Y.

- ***Failure-proof***
- ***Leak-free***
- ***Savings in time, effort and materials***

How to braze piping

BECAUSE OF ITS FAILURE-PROOF, leak-free joints, silver brazing is rapidly becoming standard procedure in commercial plumbing.

And the contractor, builder and architect are equally pleased with the resulting savings in time, effort and job materials.

Silver brazing alloys form a joint which, for all practical purposes, makes the two brazed parts a continuous piece of metal. The alloy and parent metal actually dissolve together and create an alloy frequently stronger than either the brazing alloy or base metal.

Brazing alloy flows into a joint by wetting the parent metals and distributes itself between the two by capillary action. As the temperature is raised, the alloy thins out and flows more readily. So by applying relatively more heat to the cup base, the operator can direct the molten alloy from the fitting's face down into the cup, regardless of its position.

Before the silver alloy will fill the joint, however, two conditions must be satisfied: (1) The gap between joint surfaces must not be so large that the molten film bridge is pulled apart; and (2) joint surfaces must be in a condition to be wet (clean surfaces, free of oxide, scale, dirt, grease).

Controlling joint clearance is important since it not only aids alloy flow but also affects joint strength, which increases as joint clearances are narrowed to 0.003 in.

With smaller clearances, parent metals can absorb much of the stress otherwise concentrated in the layer of ductile alloy. Proper clearance during fit-up will assure maximum joint strength.

Besides having clean joint surfaces at the beginning, formation of oxides and scale must be prevented during heating to insure proper alloy wetting. Most metals quickly form oxides when heated; and this is one function of flux.

Flux blankets the surface, excludes air, eliminates any oxides which do form and cleanses the surface ahead of the advancing alloy. The outer surfaces of the pipe and fitting should be fluxed for several inches past the immediate joint area to prevent oxidation and discoloration of the metal by the torch flame.

Almost any kind of metal pipe and fittings can be brazed with silver alloys, including brass, copper, bronze, steel, wrought iron, copper-nickel and stainless.

For most non-ferrous work a silver-copper-phosphorous alloy is used. It should not be used, however, on ferrous metals since it does not wet well and the phosphorous combines with iron to form iron phosphides, a brittle, low-strength material.

Where one or both parts of a joint are ferrous, an alloy containing cadmium and zinc should be used. On large-diameter work where fitting tolerances are difficult to maintain, a 3% nickel alloy is recommended because of its wide melting range and sluggish flow.

This alloy bridges gaps easier and is also recommended for brazing stainless steel tubing and fittings since its nickel content inhibits crevice corrosion.

Most fittings are designed for hand-feed brazing. However, another available type has a ring of brazing alloy inserted in a groove in the cup's interior wall.

The oxyacetylene hand torch is still the most common means of applying heat for brazing. (Blow

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torches or other torches designed for soft soldering do not supply enough heat). The operator should have available a sized selection of torch tips to produce proper heating on various pipe sizes.

Any tip used should be designed specifically to produce a soft spreading flame that will wrap around and heat several square inches of surface at a time. Multi-orifice tips are especially recommended for large-diameter pipe. A welding or similar tip will quickly overheat and distort a pipe.

The torch should be fitted with a flexible copper tube at least 10-in. long between tip and torch handle. This tube will allow the operator to bend the torch and play the flame behind limited-access joints without awkward hand positions. Use a light, easily-handled torch to prevent fatigue.

Pipe and fitting must both be at brazing temperature when the alloy is added. If only one is, the alloy will wet only the hotter one, or may not flow at all.

The higher a metal's conductivity, the more rapidly it transfers and loses heat to adjacent metal and to the air. Copper's conductivity is more than double that of red brass; about eight times that of iron and steel; about 25 times that of stainless. When dissimilar metals are to be brazed, the more conductive one should receive more heat to make up for its faster rate of heat dissipation.

With low-conductivity parts the operator should apply less heat and take care not to dwell too long in one area since it can easily become overheated, distort or oxidize. Similarly, heavy sections (fittings) require more heat to reach brazing temperature than do thin sections (pipe) because of their larger mass.

After generally preheating pipe and fittings, play the heat around the cup base to draw the alloy in from the fitting's face. (If a fitting with a preplaced alloy-ring insert is used, more heat should be applied to the fitting's face to draw the alloy out from inside.)

An overheated fitting will expand away from the pipe, enlarging the gap so that the alloy will not flow. In this case, remove the flame and let the fitting cool slightly and shrink back to size before adding more alloy.

Joint preparation is one of the most important considerations in pipe brazing. First cut the pipe with a hack- or power-saw using a square-end sawing vise or straight-edge ring jig to get a square end, so the pipe will bottom evenly against the cup's shoulder. Because of deformation, a pipe-cutter is not recommended for any thin-walled tubing.

Proper pipe length is the distance between the faces of the two fittings plus the cup depth of each. (Cup depth is standard for each size and type of fitting.) Then ream or file burrs from inside and outside edges around the cut or they may interfer with the fit.

To assure proper fit, scribe a line on the pipe the same distance

Brazing alloy consumption

Pipe size	0.050 x 1/8 in. strip (524 in./lb)	3/64 in. wire (1692 in./lb)	1/16 in. wire (965 in./lb)	3/32 in. wire (423 in./lb)
¼		1½	¾	
⅜		2	1	
½	1¼	4	2	1
¾	2	6	3	1½
1	3½		4	2
1¼	4		5	2½
1½	4½			3¼
2	8			6½
2½	12			9½
3	16			14½
3½	20			17
4	24			20
5	35			25
6	45			36

Recommended tip sizes for pipe brazing

Standard pipe size (inches)	Tip size no.	Torch tip drill size no.	*Acetylene consump.	**Acetylene, Oxygen pressure (approx.)
¼	4	54	15.9	4
⅜	4	54	15.9	4
½	5	51	24.8	5
¾	5	51	24.8	5
1	6	48	31.6	6
1¼	6	48	31.6	6
1½	7	44	38.7	7
2	8	40	60.0	7
2½	8	40	60.0	7
3	9	35	70.0	7½
3½	9	35	70.0	7½
4	10	30	88.5	9
5	10	30	88.5	9
6	10	30	88.5	9

Calculate oxygen consumption as 1.1 times acetylene consumption

***Increase gas pressures for hose lengths over 25 ft*

as the cup depth plus one inch. On the trial fit if the mark is more than one inch past the fitting's face (and there are no burrs or other obstructions) the fit may be too snug or the pipe out of round.

Reduce pipe diameter evenly then with an emery cloth, a straight-cut file or a sizing tool. Do not use cutting oil, and avoid thinning down any one area or removing too much metal.

Occasionally the pipe end will be undersized because of handling or cutting. The end can then be expanded with a drift pin or plug for pipes 2 in. or smaller, and with a sizing jig for pipes larger than 3 in.

As mentioned above, cleaning is a primary requirement. Both pipe end and the cup's inside surface must be free of oil, grease, rust and oxides. Use an emery cloth here, but do not use steel wool since it leaves small steel slivers embedded in soft copper.

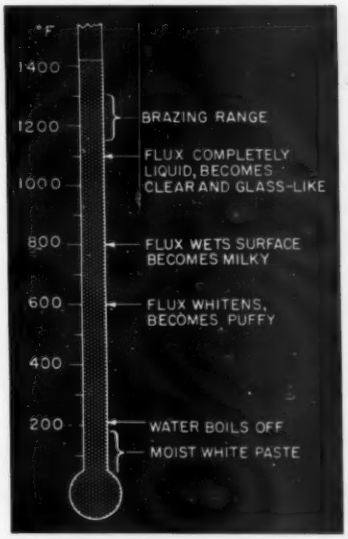
Clean (but do not polish) the pipe surface about 3 in. from the fitting's face so alloy will flow easily into the joint. Remove oil and grease by dipping or brushing with a good solvent.

Once cleaned, do not handle the parts or lay them where they can become contaminated again. If they must be laid aside before using, wrap them in clean paper or cloth.

When you are ready to braze, brush a coating of flux on the joint area and inside the cup. Flux should be thin enough to spread easily but without excessive dripping. Thin any dried flux with water.

Always use flux regardless of how the parts have been cleaned since oxides form as soon as heating starts. Flux protects the joint from air, removes oxides formed during heating. Do not use too much flux inside the fitting to avoid circulating it through the system when water is turned on.

After parts are fluxed and assembled, revolve the fitting a few turns to spread flux uniformly. Then check the scribe mark to be sure the pipe is bottomed properly. After fit-up apply some flux around the end and outside of the fitting with a clean brush.



CHANGES in appearance of flux during heating provide a useful guide to temperature of pipe and fitting.

Time and effort can frequently be saved by sub-assembling some parts (headers and manifolds). When pre-brazed on a bench, such joints are more accessible, heating is faster and alignment and support methods are simplified .

To assure that the pipe supports the fitting, use vee-blocks, clamps, wire, wooden braces or pipe hangers, positioned so as not to interfere with torch movement. Large metal supports should be positioned away from the joint so they will not absorb any joint heat.

If clamps are used, do not screw them tight. Pipe must be able to expand when heated or it will bow and misalign when the alloy solidifies, especially on return bends.

When actual brazing begins, use a slight excess of acetylene to produce a reducing flame (recognized by the greenish feather above the inner blue flame-cone). Hold the torch far enough from the work so that flux is not flushed away; use a low-velocity, bulbous single or multi-flame torch tip.

On small diameter pipe joints, preheat the fitting and pipe to black heat, then heat around the pipe some ½ to 1 in. below the fitting. Heating the pipe first causes it to expand against the fitting and warm the cup wall.

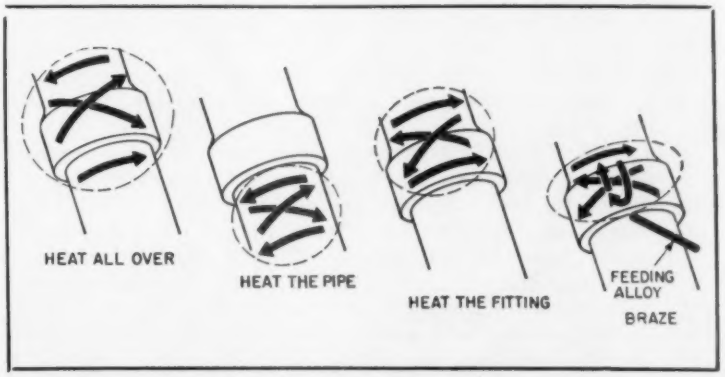
Keep the torch moving in a circular motion around the pipe for uniform heating. Then continue heating the pipe until it reaches approximate brazing temperature, indicated by the flux's clear, glass-like appearance.

Changes in flux appearance are a convenient temperature indicator, white paste at room temperature to a transparent film at about 1,100 F. After flux turns glassy, another few seconds of heating will bring the part to brazing temperature.

Follow the same procedure to bring the fitting to temperature, allowing some flame to splash on the pipe to avoid its cooling. Both fitting and pipe must be at brazing temperature at the same time.

As the fitting is heated, flux will bubble out from inside the cup. Keep the flame moving back and forth from the fitting's edge to the cup's full depth taking care not to overheat any one area.

When the flux on the fitting becomes glassy, apply the silver brazing alloy, after brushing a little flux on the first few inches of alloy



RECOMMENDED procedure for heating a joint prior to brazing.

Special heating techniques

(1) With pipes having larger than 1-2 in. OD, where it is difficult to maintain the entire circumference at a uniform temperature, sectional heating is recommended. Complete the joint by brazing 2-in. sections of the circumference in succession, following the same procedure for heating and applying alloy as previously described. Be sure to overlap the braze from one segment to the next so that a continuous joint is obtained.

(2) To braze joints in horizontal, large-diameter piping, start with a segment at the top of the pipe. Then braze a segment on each side, overlapping each with the ends of the top segment. When the side segments are done, there will be a globule of run-off alloy at the lower end of each segment. Heat the fitting's bottom and, by moving the torch back and forth, melt these alloy globules and draw them into the bottom segment.

Be sure to heat the fitting's bottom well so as to pull the alloy fully into the joint, adding more alloy if needed. The fillet at the bottom of the pipe will be larger than ordinary because of some runoff from top and sides. To minimize this, let each brazed segment solidify before starting on the adjacent segment.

(3) Vertical joints are perfectly feasible with a little practice. The trick is in applying heat where it can work best. Heat pipe and fitting as usual, but be especially careful not to overheat the pipe, otherwise the alloy will tend to run down the pipe.

When flux indicates that brazing temperature is reached, touch the alloy to the joint. At this time play the heat along the cup base so that the alloy will be pulled up into the cup. Keep the inner base of the cup hotter than any other joint part.

(4) Vertical down joints are probably the easiest. Start at any point and work around the circumference of the joint segment by segment until completed.

(5) With fittings having both brazed and threaded ends, do not braze next to the screwed joint. Heat will damage the compound used to seal the threads. Make up the brazed end or ends first, then the threaded end. A union is recommended for any installation containing a brazed fitting that screws into a tapped hole on stationary equipment.

(6) When brazing unions, protect the ground sealing surfaces with a generous flux coating. This will keep them from tarnishing when heat is applied to make the joints. In any case, do not play the torch flame directly on the ground surfaces.

(7) When brazing flanges, an even preheat is important. Improper heating can warp the mating, seating flange surface, causing leaks. In an extreme case, a flange can be cracked by careless heating. Keep heat away from the flat mating surface; direct the flame against the hub where it will heat the cup. After heating the pipe, use a back-and-forth motion around the hub to heat the flange. Then wipe the flame from the pipe across the hub and back again to keep both parts hot during the rest of the brazing operation.

rod or wire and warming it slightly in the flame.

As a test, touch the alloy end briefly to the joint edge. If the sample melts and flows, brazing can proceed; if not, heat pipe and fitting a little longer.

When the temperature is right, feed the alloy in by touching it to the joint gap. Play the flame along the cup base to draw the molten alloy down into the cup. But do not melt the alloy with the flame; let it melt by contact with the hot surfaces.

Feed in only enough alloy until a fillet appears at the chamber of the fitting's face. When the fillet appears, the joint is complete and further heating is unnecessary. However, if the fillet is not continuous around the pipe, apply additional heat and, if needed, a little more alloy.

To remove flux, swab or brush the joint with water as soon as possible after alloy solidification. With the flux still hot, the thermal shock will crack the flux, making removal easier. Wire-brush any remaining flux.

A water pressure test is the most reliable testing method since water will dissolve any hardened flux which could easily mask small leaks in a pneumatic test. If the latter test is used, however, dislodge the flux from inside surfaces by rapping the joint with a wood or lead mallet. A soapy solution brushed on the joint will easily show pinhole leaks.

If brazed fittings must be removed for any reason, first brush flux around the joint, then heat the pipe and fitting, directing most of the heat on the fitting. After enough heat is applied, the brazing alloy will liquify and the pipe or tube can be pulled from the fitting with a gentle twisting motion.

If the pipe does not come out easily, do not force it; apply more heat until all the brazing alloy is melted.

These pipes and fittings, of course, should be thoroughly cleaned before re-use. Adhering alloy should be removed while still hot after the joint has been pulled apart.

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Aluminum pipeline makes steady gains

ALUMINUM test section is floated into position. The trench flooded during digging because the region is close to sea level. Pipe had a wall thickness of 0.432 in. at the ends, and 0.272 in. along its length. This variation cut pipe cost by 20%, according to Alcoa.

ALTHOUGH STEEL continues to be the most widely used metal for pipelines, aluminum has been making steady inroads on this supremacy.

Advantages claimed for the lightweight alloy in gas line systems include corrosion resistance, increased gas flow because of smooth interior surfaces, non-sparking characteristics, ease of handling, and elimination of maintenance painting.

An example of this confidence in aluminum was an installation at Baton Rouge, La., where more than 1,600 ft of seamless pipe serves the local alumina plant of Kaiser Aluminum & Chemical Corp.

Buried steel pipe which formerly served the plant had been exposed during excavation and revealed severe corrosion. In designing the aluminum line, it was decided to construct it above-ground because of the presence of complex underground installations and major plant streets.

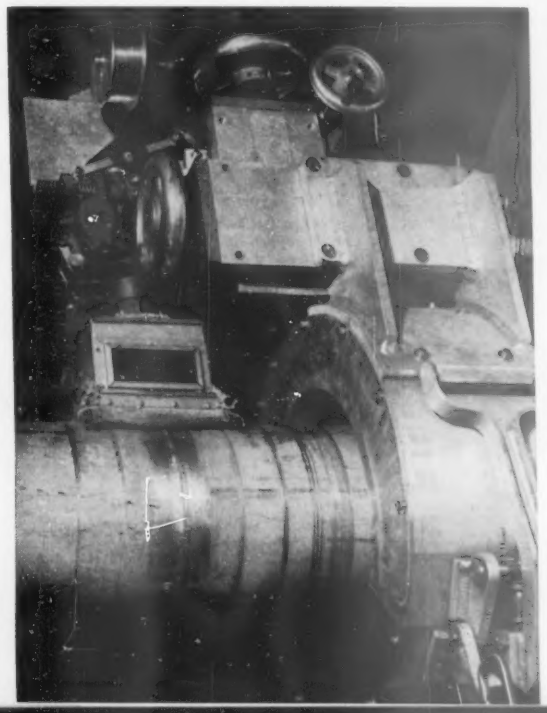
In fabricating the line, both Mig and Tig welding were used. Tig welding was done using a-c current with a bare 3/16-in.-diameter A-5356 aluminum filler rod. Mig welding used d-c current with 3/64-in.-diameter A-5356 aluminum wire.

A second aluminum installation was a mile-long test section, linking a Louisiana well with the gathering system of Columbia Gulf Transmission Co., Houston, Tex. The 6-in.-diameter line of 6061-T6 aluminum was produced by Aluminum Co. of America, Pittsburgh.

Recent developments which advanced the cause of aluminum pipelines include a seamless, one-piece tube with a heavier wall thickness at pipe ends than along the length, and a welder able to produce sound welds with full penetration without use of back-up rings.

With the use of both the new tube and welder, Alcoa completed a 4,500-ft, 8-in. pipeline at its Point Comfort, Tex., operation. Piping here was Schedule 40 in alloy 6063-T6. Nominal wall thickness at pipe ends was 0.322 in., while along the length it was 0.204-in.

The automatic welder made 8-in. circumferential welds in 17 seconds, further helping to cut the cost differential between aluminum and steel piping.



LEFT — Head of automatic pipe welding machine developed by Aluminum Co. of America, Pittsburgh, can be positioned through a wide range of welding angles. It can also be set to oscillate, automatically moving back and forth across weld width to insure complete filling. ABOVE — after two 40-ft sections of pipe are joined, joint is brushed and inspected.

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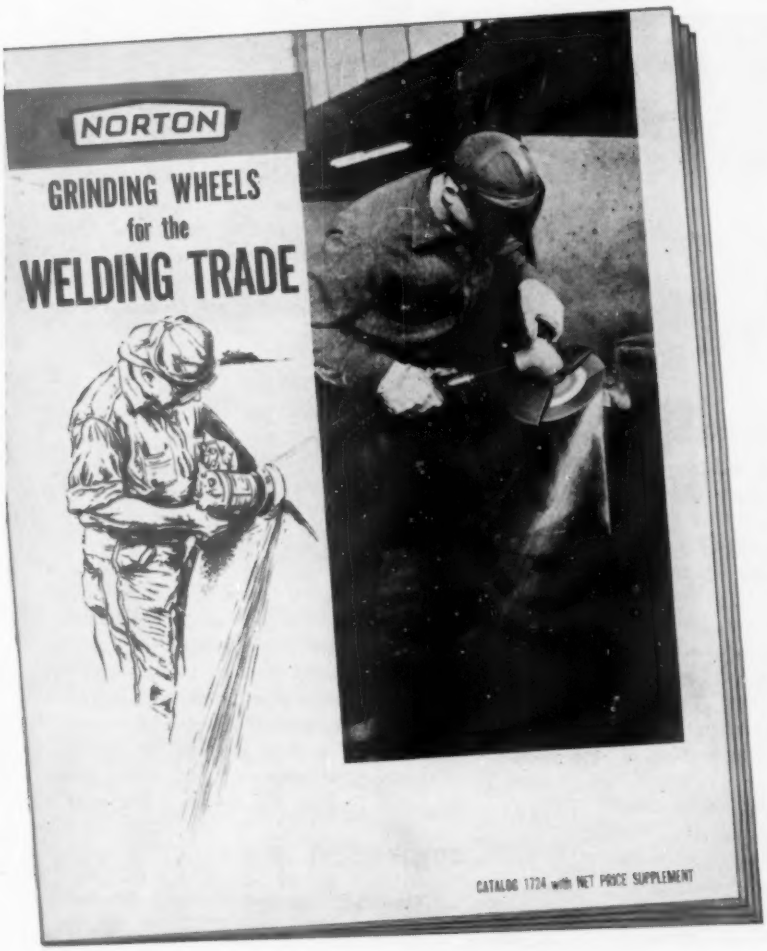

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All Norton resinoid wheels, incidentally, are now produced in the new 5-acre Norton Worcester Plant No. 8, on the most modern equipment ever developed. The Norton weld grinding favorites made here include the reinforced types — BD and BDA rigid and BFR semi-flexible — plus straight wheels, cut-off wheels, cups, cones and mounted wheels.

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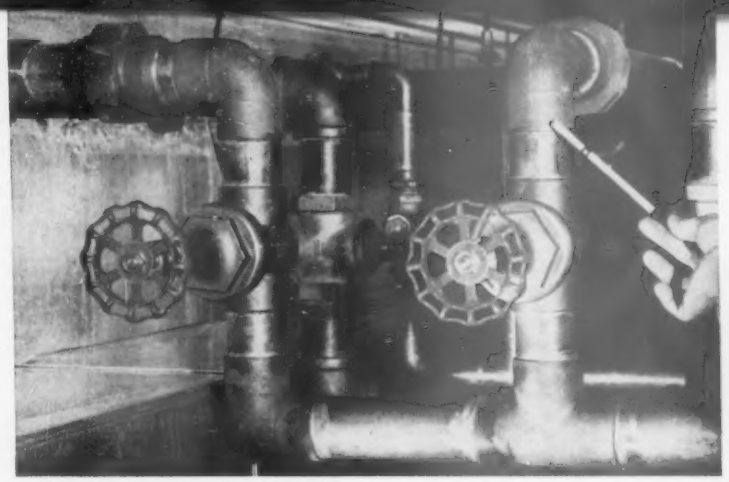


JOINTS made with silver-bearing soft solder are shown in pipe tunnel. Copper tubing ranges from ½ to 2½ in. At right, Val Kohler heats copper elbow to soldering (430 F) temperature. Low heat eliminates burning.

Silver-bearing solder solves copper piping problem

by **Charles Bastion**
Regional Manager
All-State Welding Alloys Co., Inc.

A TOTAL OF 31,000 ft of copper piping was required for the new Science Building of the Western Washington College of Education, Bellingham, Wash.

But the area's water, containing lime, magnesium and iron carbonates, caused lead-tin solders to etch and copper pipe joints to fail.

The high-temperature silver solders and phosphor-copper-silver brazing alloys could not be used since their melt point of 1,100 F burns copper piping.

The solution: a rapid-flowing, non-toxic silver-bearing soft solder with a low work-temperature of 430 F.

The design engineers, James B. Notkin and Associates, first investigated a hard, high-analysis silver solder with a phosphor-copper-silver brazing alloy alternate for the pipefitting work. Results, as mentioned above were unsatisfactory.

Paul Johansen, Jr., one of the owners of Diamond "B" Plumbing and Heating Co., the piping contractor, had solved similar corrosion problems with a silver-bearing soft solder manufactured by All-State Welding Alloys Co., Inc., White Plains, N. Y.

The soft solder was first used by the plumbing company for the Jefferson Elementary School contract at Mt. Vernon, Wash., and was later used again on the Shuksan Junior High School project in Bellingham in 1957. Johansen then demonstrated the soft solder to the Notkin engineers.

Test results were evaluated by the design engineers and were found favorable. Specifications were then written approving the silver-bearing soft solder.

The soft solder is attacked by strong acids and alkalis, but is relatively resistant to weaker solutions. Rate of attack increases with temperature and concentration.

Its average physical properties are as follows:

For copper to copper:
Tensile — 14,300 psi
Shear — 11,200 psi
Elongation in 2 in. — 21%
For stainless steel to copper:
Tensile — 10-28,000 psi
Shear — 10-15,000 psi
Elongation in 2 in. — 10-28%

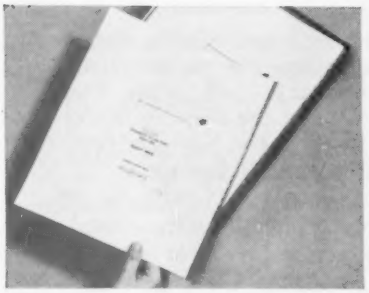
On the job, copper piping varied in size from ⅜ to 2⅛ in. with joints sweat-fitted. According to Johansen, "The solder has good flow characteristics on tight or loose fit-ups. Its corrosion resistance is excellent."

Since copper burning was eliminated, even inexperienced men were able to make satisfactory joints without close supervision. Savings included lower fuel consumption, lower pipe costs and less down time.

Comparison test results

	Tin-lead	Silver-bearing	Silver
Non-toxic	no	yes	at times
Low heat	yes	yes	no
Low cost	yes	yes	no
Corrosion resistance	no	yes	yes
Color match	no	yes	yes
Chrome plating	no	yes	yes
Low distortion	yes	yes	no
High strength	no	above average	yes
Iron and torch applications	yes	yes	no

TABLE shows results of comparison tests between tin-lead, silver-bearing and high-analysis silver solders.



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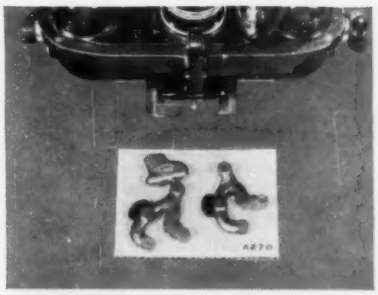

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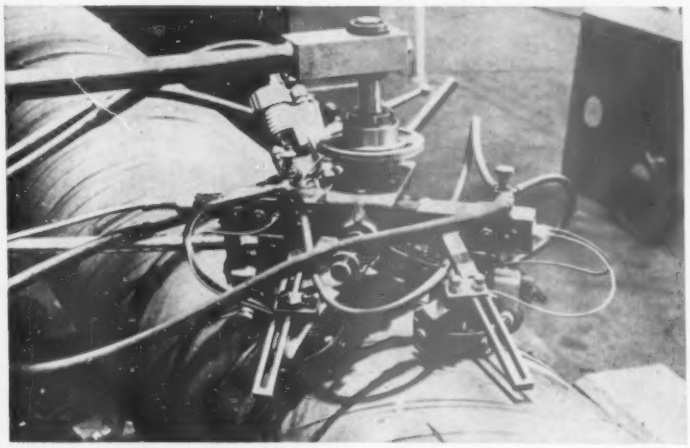
Ultrasonic system tests pipe in 3 dimensions



PIPE CAN NOW BE tested 100% ultrasonically in three dimensions in the weld area with new equipment designed by Driam Corp., Manitowoc, Wis. Four sonic heads beam the waves in a manner that results in recorded echoes from defects lying in any plane.

Paint is automatically sprayed on the defective area to facilitate visual inspection, or X-ray if warranted; an audible signal is also triggered by the echo from a defect. In addition, a luminous screen is included on the instrument panel. A complete graphic record of the test results is printed by the automatic recorder.

The device uncovers and identifies pores, longitudinal and transverse cracks, notches, slag streaks, bond failures, root defects, etc.

An entire strip of steel itself can be tested for defects with sonic heads mounted between the coil box and the forming and welding area, with a separate recorder, audible signal, and luminous screen.

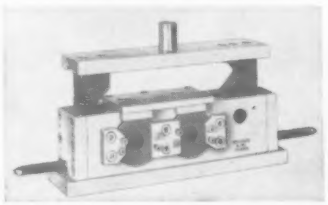
The system is easily adaptable to the firm's trailer-mounted mobile pipe machines, permitting testing while the pipe is produced on site. Driam's system has been used in France since the fall of 1959 to test gas transmission pipe.

Circle No. 1

. . . and here are other new products in the piping area:

Notching tandem

No. 102 Arc-Twin Tandem makes two complete notched ends (four notchings) of either pipe or tubing with one stroke of the punch press. This means that two pipes or tubes can be double-notched at one end simultaneously in a single press stroke, or one pipe or tube double-notched at both ends in one stroke. Same unit can make a variety of slottings such as "T", flared or long narrow slots with the same precision and speed. By use of firm's No. 110 outboard locator, notchings at both ends of a single pipe can be accurately and automatically aligned or positioned with relation to each other. *Vogel Tool and Die Corp.*



Circle No. 2

Pre-shaped fittings

Manufactured of high-strength seamless tubing in three weight schedules, pre-shaped saddle fittings are available in 45-deg angles. Fittings come in A-53 for most requirements and A-106 Grade B for higher applications. Sizes range from 1-in. through 12-in. for welding and 1-in. through 4-in. for threaded filling. Special fittings 1-in. through 36-in. in aluminum, alloy or stainless steel are available in any desired angle. Fittings are leakproof, strong, lightweight and easy to handle, according to *Allied Piping Products Co., Inc.*

Circle No. 3

Portable rotator

Powered pipe-rotator headstock positions, clamps, and rotates pipe, permits efficient work handling and natural downhand welding. Used in the field or in-plant, the rotator is built in four sizes to handle pipe in the following diameter ranges: 1-in. to 12-in.; 8-in. to 24-in.; 16-in. to 36-in.; and 20-in. to 48-in. Depending on pipe diameter, speeds range from 2 to 160 ipm. Design features single lever-operated, 3-jaw chuck and a detachable self-contained variable speed electric control unit. *World Electric Co.*

Circle No. 4

Portable repair kit

Portable repair kit is designed for simple, rapid, permanent repairs to pipe and tubing, pipe joints, pipe fittings, and tanks and other vessels. Leaking bell and spigot joints, flanges, saddles, and caulked sleeves, as well as cracked valve bonnets and leaking threads can be quickly repaired by ordinary labor, according to *Dresser Mfg. Div.*

Circle No. 5

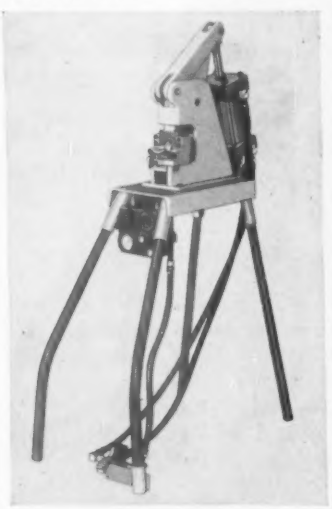
Curved preforms

Curved washers and shims for tubular brazing applications are custom manufactured of silver alloys to meet individual requirements. Curving of washer to cur-

vature of tube minimizes problems of proper fit, states *Lucas-Milhaupt Engineering Co.*
Circle No. 6

Beveling machine

Newly designed line of pipe-beveling machines features shorter, balanced ring gear-saddle assembly, making it possible to cut on shorter segments of pipe. Compact unit reduces storage space by approximately one-half. Design has also cut excessive weight from machine. *C. A. Mathey Machine Works, Inc.*
Circle No. 7



Compact air press

Arc-Fit compact air press was built to accommodate firm's Arc-Fit notcher, which can notch upwards of 1,000 pieces per hour. Press, of 8-ton capacity, readily notches standard piping up to 2-in. and tubing up to 2⅜-in-OD, states, *Vogel Tool & Die Corp.*
Circle No. 8

Here's WE's complete list of manufacturers of pipe welding accessories

ALIGNMENT CLAMPS

Contour Marker Corp., Compton, Calif.
M. J. Crose Mfg. Co., Inc., Tulsa, Okla.
Line-O-Tool Co., Houston, Texas
C. A. Mathey Machine Works, Tulsa, Okla.
Pipe Line Development Co., Cleveland, Ohio
Wales-Strippit Inc., Akron, N.Y.

BACKING RINGS

Arcos Corp., Philadelphia, Pa.
Cayuga Machine & Fabricating Co., Inc., Depew, N.Y.
Commerce Pattern Foundry & Machine Co., Detroit, Mich.
Duramic Products, Inc., Palisades Park, N.J.
General Ceramics Corp., Keasbey, N.J.
Grinnell Co., Inc., Providence, R.I.
Mansol Ceramics, Belleville, N.J.
Midwest Piping & Supply Co., Inc., St. Louis, Mo.
Nyala Corp., Philadelphia, Pa.
Oxo Welding Equip. Co., New Lenox, Ill.
Riverside Machinery Co., Chicago, Ill.
Robvon Backing Ring Co., Elizabeth, N.J.
Wedge Protectors, Inc., Cleveland, Ohio

BEVELING MACHINES

Air Reduction Sales Co., New York, N.Y.
M. J. Crose Mfg. Co., Inc., Tulsa, Okla.
H & M Pipe Beveling Machine Co., Tulsa, Okla.
C. A. Mathey Machine Works, Inc., Tulsa, Okla.
Nickelson Tool & Die Co., Inc., Wichita, Kans.
Pandjiris Weldment Co., St. Louis, Mo.
Speedi-Burn Products, Inc., West Hempstead, N.Y.
Stahl Equipment Co., Brookline, Mass.
Steffan Mfg. Corp., Salem, Ohio
Vernon Tool Co., Ltd., Alhambra, Calif.
Wallace Supplies Mfg. Co., Chicago, Ill.

BEVELING TOOLS

Beaver Pipe Tools, Inc., Warren, Ohio
M. J. Crose Mfg. Co., Inc., Tulsa, Okla.
H & M Pipe Beveling Machine Co., Tulsa, Okla.
C. A. Mathey Machine Works, Tulsa, Okla.
Oster Mfg. Co., The, Cleveland, Ohio
Stahl Equipment Co., Brookline, Mass.
Tri-Clover Machine Co., Kenosha, Wis.
Vogel Tool & Die Corp., Melrose Park, Ill.
Wallace Supplies Mfg. Co., Chicago, Ill.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N.Y.

CUTTING MACHINES

Allison-Campbell Division, Am. Chain & Cable Co., Inc., Bridgeport, Conn.
American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins, E. C., & Co., Indianapolis, Ind.
Beaver Pipe Tools, Inc., Warren, Ohio
Capewell Mfg. Co., The, Hartford, Conn.
Crose, M. J. Mfg. Co., Inc., Tulsa, Okla.
Disston, Div., H. K. Porter Co., Inc., Philadelphia, Pa.
H & M Pipe Beveling Machine Co., Tulsa, Okla.
Heath Engrg. Co., Ft. Collins, Colo.
Herbrand Tools, Freemont, Ohio
Mathey, C. A., Machine Works, Inc., Tulsa, Okla.
Nickelson Tool & Die Co., Inc., Wichita, Kans.
Nye Tool & Machine Co., Chicago, Ill.
Oster Mfg. Co., The, Cleveland, Ohio
Quijada Tool Co., Inc., Los Angeles, Calif.
Ridge Tool Co., The, Elyria, Ohio
Simonds Saw & Steel Co., Fitchburg, Mass.
Speedi-Burn Products Co., West Hempstead, N.Y.
Stahl Equipment Co., Brookline, Mass.
Steffan Mfg. Corp., Salem, Ohio
Toledo Pipe Threading Machine Co., The, Toledo, Ohio
Trimont Mfg. Co., Div. of Aetna Industrial Corp., Roxbury, Mass.
Vernon Tool Co., Ltd., Alhambra, Calif.
Vogel Tool & Die Corp., Melrose Park, Ill.
Wallace Supplies Mfg. Co., Chicago, Ill.

LAYOUT TOOLS and TEMPLATES

Contour Marker Corp., Compton, Calif.
Interstate Sales Co., New York, N.Y.
Lee, R. E., Long Beach, Calif.
Sury Engrg. & Sales Co., Glendale, W. Va.

WELDING FITTINGS

Allied Piping Products Co., Inc., Salem, Ohio
Babcock & Wilcox Co., Beaver Falls, Pa.
Cooper Alloy Foundry Co., Hillside, N.J.
Crane Co., Chicago, Ill.
Dresser Mfg. Div., Bradford, Pa.
Grinnell Co., Providence, R.I.
Ladish Co., Cudahy, Wis.
Lenape Hydraulic Press & Forging Co., West Chester, Pa.
Midwest Pipe & Supply Co., Inc., St. Louis, Mo.
Nibco, Inc., Elkhart, Ind.
Oxo Welding Equip. Co., New Lenox, Ill.
Porter, H. K., Co., Inc., Roselle, N.J.
S & L Mfg. Co., Gardena, Calif.
Taylor Forge & Pipe Works, Chicago, Ill.
Tube Turns, Louisville, Ky.
Victaulic Co. of America, Elizabeth, N.J.
Walworth Co., New York, N.Y.
Welding Fittings Corp., Newcastle, Pa.

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Hazards in welding cadmium plated material

Question:

We are setting up safety procedures to be followed when welding cadmium plated material and are looking for advice. Do you have any information or suggestions on such procedures?

Answer:

The fumes arising from cadmium as it is welded or flame-cut can be almost as dangerous as those from lead. This fairly popular plating material must never be heated to high temperatures by a weldor working without an air-line or filter-type respirator.

The difference in behavior of zinc- and cadmium-plated materials when heated with an oxyacetylene flame should be remembered.

According to tests at the research laboratory of Linde Co., New York City, zinc on galvanized sheet appears to volatilize as oxide almost simultaneously with melting. Dense white fumes are emitted, and they precipitate heavily on adjacent plate. It is extremely difficult to melt zinc without this heavy fuming.

In contrast to zinc's behavior, cadmium definitely melts before it volatilizes. Immediately following flame application to cadmium plate, the material agglomerates in molten droplets, then evaporates and oxidizes.

These are the hazards of welding such material. But don't forget that "hazards" remain simply a potential factor until carelessness brings them to life. It's up to the weldor, his supervisor, and all of top management to see that carelessness ceases to plague industry generally, and the welding field in particular.

The variety of equipment now available to do an adequate cleansing job on the air surrounding a welding arc is sufficient for any individual or plant need. But just where should such equipment be placed, and in what volume should it replace impure air with "breathable" air?

Not all health authorities are in agreement on what constitutes adequate ventiliation. The Public Health Service specifies one complete air change every one to four minutes as a guide for all locations.

Another recommendation by an eminent research team noted that open shops may not need local exhausts at weldor's benches, but that where production work is being handled, individual fume-removal ducts are desirable.

As a guide covering the latter type of operation, the researchers recommend that exhaust hoods be placed within 8 in. of the work, and that they draw about 200 cfm of air per weldor. If general ventilation is to be used, the team recommends that at least 400 cfm of air be withdrawn.

It is the opinion of still another medical authority that all spaces of less than 5,000 cu ft cannot safely be ventilated in a natural manner (i.e., in tanks or vats). He also believes that all local exhausts should maintain an air velocity at the point of welding of 100 lineal ft per minute away from the weldor's breathing zone.

Coupled with recommendations for local and general air exhaustion is another item of good (and sometimes *mandatory*) advice: wear a respirator or a supplied-air mask or helmet wherever doubt exists concerning degree of protection afforded by other types of ventilation.

Question:

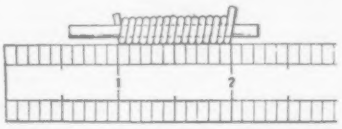
Can you suggest an accurate, inexpensive way of measuring small wire diameters?

Answer:

In the sketch below, W. F. Schaphorst, Newark, N. J., shows a simple method of measuring wire diameter with an ordinary scale or ruler.

Wind the wire on a round stick or rod as shown, so that all of the wire turns make contact throughout; there must not be any gaps between the turns.

Count the number of turns per inch and divide into one. Thus, if



there are 16 turns per inch as shown, we have 1 divided by 16 equals 1/16th, or 0.0625-in., which is the diameter of the wire. If there are 50 turns per inch we have 1 divided by 50 equals 0.02-in. In the case of 80 turns: 0.0125-in.

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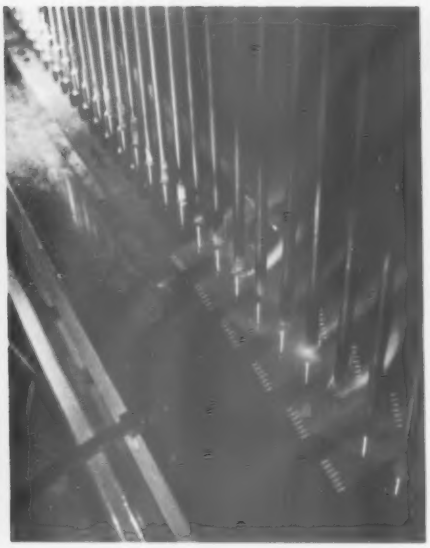

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△ Testing for gas tightness and accurate gas control— industry's highest testing standards mean Airco Regulators can be relied on for accuracy and durability.

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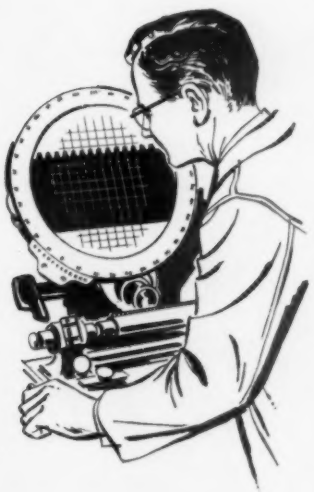

Photographs: Robert Yarnall Richie

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Testing welded pipe joints

by David E. Albrecht
Allied Piping Products Co., Inc.
Salem, Ohio

Tests were recently completed in which the ultimate burst strengths of pipe material were established. To these were compared the burst strengths of various types of welded pipe joints.

Material for the straight run pipe, which ranged in size from 2 to 12 in., was Schedule 40, A53, Grade B, seamless.

Four different pipe joints for each size of pipe were welded and tested to bursting point. The joints were: size-on-size tee-joints; reducing tee-joints; size-on-size 45 deg lateral joints; and reducing 45 deg lateral joints.

All joints were precision flame-cut on automatic machines to assure perfect fit-up for welding and were prepared for an "outside" type saddle.

In the outside saddle, the contoured branch is beveled around the entire periphery and the hole in the straight run pipe is cut straight through to match the inside diameter of the branch.

The branch was tack-welded to the run pipe with a 1/8-in. gap to allow for 100% penetration of the weld metal to be deposited from the outside.

The weldor then laid a stringer bead and completed the weld build-up according to accepted welding practice. Manual welding was done in the downhand position using 5/32-in.-diameter E6011 or E6012 electrodes.

The charts and graph at the right show only a partial result of these tests. Figure 1 is a comparison between the bursting strengths of a reducing tee-joint and the straight run pipe.

In all the tests, failures always occurred in the run pipe adjacent to the weld. In no case did the branch pipe burst or a weld failure appear.

Figure 2 compares the results of bursting tests on welded reducing tee-joints with various code requirements for operating and bursting pressures. The graph illustrates the ample reserve strength above the code requirements.

REDUCING TEE

Pipe Size	Burst P.S.I.	% to Yield	% to Ultimate
1½ on 2	10,500	129%	96%
2 on 3	8,400	116%	87%
3 on 4	6,500	110%	80%
4 on 5	6,200	120%	89%
5 on 6	4,800	102%	76%
6 on 8	4,200	120%	89%
8 on 10	3,500	113%	90%
10 on 12	3,075	112%	80%

STRAIGHT RUN

Pipe Size	Theor Yield P.S.I.	Theor. Ultimate P.S.I.	Actual Burst P.S.I.
2	8,150	11,130	11,000
3	7,200	10,000	9,600
4	5,920	8,300	8,200
5	5,175	7,250	7,000
6	4,675	6,550	6,300
8	3,460	4,830	4,700
10	3,100	3,900	3,700
12	2,750	3,840	3,600

FIGURE 1

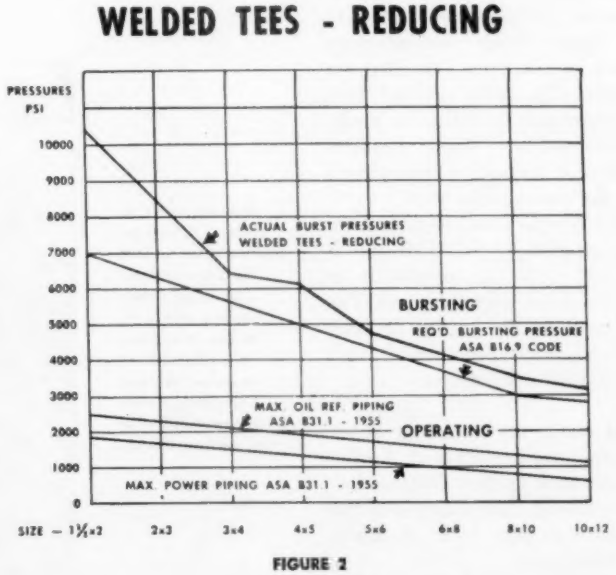
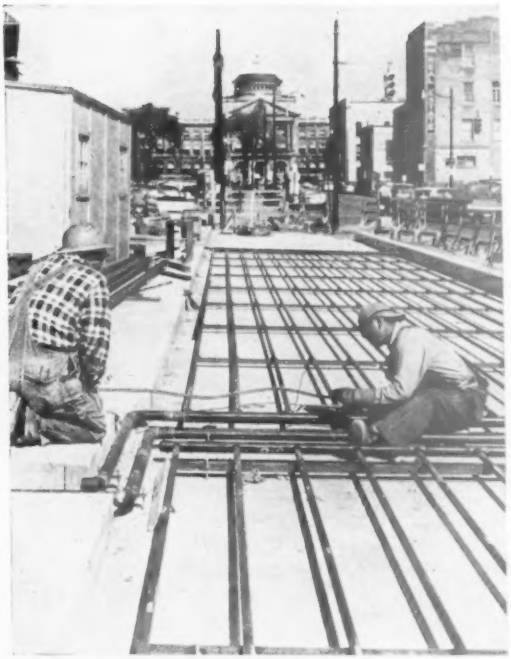


FIGURE 2



SNOW-MELTING system installed in sidewalk adjacent to Libby-Owens-Ford building, Toledo, Ohio, is fabricated from wrought iron pipe. Here, weldor joins sections, which will later be covered with terrazzo topping.

Welded piping used in radiant heat systems

OXYACETYLENE WELDING of pipe sections provided an automatic snow melting system for the new 15-story Libbey-Owens-Ford Glass Co. building in Toledo, Ohio.

The grid system—fabricated from corrosion resistant 4-D wrought iron pipe—utilizes 1-in.-diameter laterals welded to 2-in-.diameter headers. The grids are laid in a depressed concerete slab on grade, and encased in 5 in. of concrete. A terrazzo topping is then placed over the entire plaza area.

During operation, heat transfer oil is circulated at 140 to 160 F and will melt the snowflakes as they touch the heated surface. The snow-melted area consists of three sidewalks, each 14- x 180-ft, and a 60- x 85-ft entrance way.

Automatic snow melting eliminates the maintenance cost of older methods such as shoveling, cindering, or salting. Manufacturer of the wrought-iron pipe is A. M. Byers Co., Pittsburgh.

In another use of this welded wrought iron pipe, one of the most modern churches in the nation—St. Sebastian Church near Pittsburgh, is scheduled for a radiant heating system, the ideal method for high-ceiling structures.

The 11,000-sq-ft radiant system was installed by D. E. Hickey Co. of Pittsburgh. Fabricated on the sub-slab, the combination grid and coil system was spaced on 16-in. centers and welded to 2-in.-diameter mains. After hydrostatic testing at 125 psi for 24 hours, the 4-D wrought iron pipes were covered with 4 in. of concrete.

Water will be heated to 100 to 140 F by a boiler located in the basement at the sacristy end of the church, and will circulate through the network of pipe embedded in the main church floor. Heat will radiate to the surface, where rays will be absorbed and converted to heat energy.

The system's output of approximately 640,000 BTU will represent 70% of required building heat. The additional 30% of space heat will originate from a supplementary forced air heating system.

Radiant heating is said to offer these advantages over conventional heating methods:

— Increased comfort: with an extremely high ceiling, the heating concentration can be directed at occupant level at a uniform temperature.

— Lower operating cost: radiation theory makes it possible to maintain lower temperature when the building is unoccupied.

— Design flexibility: The system can respond rapidly to changes in the number of occupants without override or lag.

SPACED on 16-in. centers, these 1-in. laterals were welded to 2-in.-diameter mains and then covered with 3 in. of concrete. More than 9,000 ft of corrosion-resistant 4-D wrought iron pipe was installed in this modern church.

World's largest single-engine crawler welded with M&T Murex electrodes

The giant Caterpillar D9 tractor is a mountain of earth-moving muscle with a pull of 67,190 lbs. Using its seven-roller tracks, the Cat crawler can claw into the earth, push huge boulders, maul tons of dirt. The average tractor is dwarfed by the size of this monster: 23 feet long and weighing over 75,000 pounds, with equipment. In building its D9 line of crawlers, Caterpillar Tractor Co. used Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

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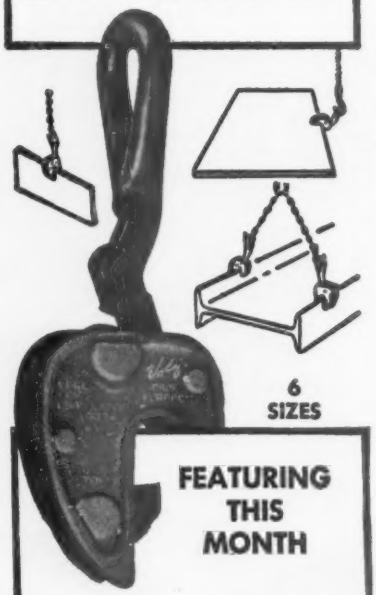

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Circle No. 182 on Reader Service Card

Canadian mill turns out large diameter pipe

ONE OF THE LARGEST continuous pipe mills in the world, now operating in Ogden, Calgary, Canada, was specially designed to manufacture large diameter high-strength transmission line pipe for oil, gas and water.

In the Big Inch Pipe Corp. operation, 60-ft (not normal 40-ft) lengths of steel plate are trimmed to required width, then moved by crane and fed into the forming mill, which works on a continuous basis to bring the formed open seam to the welding head. There it is forge-welded by means of high frequency electric resistance, then scarfed inside and out, sized, and delivered to the run-off table.

The resistance welder introduces 400,000 cps current directly into the metal by means of two small sliding contacts — one on each side of the open seam. Current at this frequency has different characteristics than the commonly used low-frequency current employed in standard resistance welding. In this case, it follows the path of low inductance, rather than the low resistance path.

The open seam of the pipe is kept in an elongated vee form as it nears the welding head, and the two contacts riding a few inches from the root of the vee introduce the high frequency current directly into the metal. Current from one contact flows down one side of the vee to the root and back along the other edge of the open seam to the other contact.

With the utilization of high frequency current the heat affected zone is small, since only the edges of the open seam are heated to welding temperature, and very little heat is dissipated into the body of adjacent metal.

The welder, manufactured by the New Rochelle Thermatool Corp., New Rochelle, N. Y., makes possible production speeds of from 25 to 75 fpm. In the case of ⅛-in. wall pipe, the speed will exceed 35 fpm.

Another feature of this process is that hot rolled steel does not have to be sand blasted or pickled to remove the scale and oxidation, thus effecting sizeable savings.

Flash and spatter in high frequency resistance welding is negligible, thus eliminating an often costly cleaning operation. The entire plant, built by the Cal Metal Corp. of California, is 600 ft long, cost more than $4½ million.

IN foreground a completed pipe section is on the run-off table. At center, a 60-ft length of steel ½-in. thick has been formed and welded into a 36-in. pipe at a speed of 35 fpm and is seen travelling to the run-off table. Power for high-frequency welding is provided by a 280-kw generator.

Nation's top-award-winning bridge welded with M&T Murex electrodes

Some time ago, the American Institute of Steel Construction announced its awards for the most beautiful bridges opened during 1958. There were over 100 entries in four classifications. Top award in its class went to the Louie Morris Memorial bridge in Hartwell, Ga. This was the sole first award to go to a welded bridge. On this winner, all welding was done by Calvert Iron Works with M&T Murex electrodes – products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

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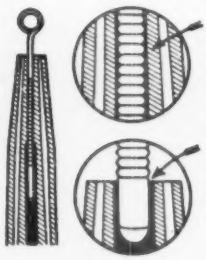

These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

This smooth pilot guides WYPO Tip Cleaner into tip. Will not enlarge or damage tip port.

This cross section view of WYPO Cleaning Surfaces shows these exclusive features: Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thorough cleaning by removing all waste.

SPRING LOADED SPOOL

Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

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NOW AVAILABLE IN 3 CONVENIENT SETS

WYPO TIP CLEANERS
STANDARD SET

CLEANER NO.	FOR DRILL
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10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49

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CLEANER NO.	FOR DRILL
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30	46-45
33	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

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MASTER SET
WYPO TIP CLEANERS

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10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
33	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

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Stainless steel vital in coil fabrication

ANODE header assembly is Tig welded to stainless steel cooling coil.

A UNIQUE INTERNAL cooling coil construction for welder ignitrons depends on stainless steel tubing for arc-back-free operation and long service life.

These ignitrons are metal, water-cooled, mercury pool vacuum tubes designed especially for welder control and similar a-c control applications.

Because the tubes contain mercury and mercury vapor, any material with which mercury readily amalgamates cannot be used for the coil. The material also must prevent oxidation from water passing through the coil. This would release nascent hydrogen, which could penetrate the wall of the tubing and destroy the vacuum inside the ignitron.

To solve these problems, National Electronics, Inc., Geneva, Ill., selected type 304L stainless steel tubing supplied by Alloy Tube Div., The Carpenter Steel Co., Union, N. J. Use of this stainless grade eliminates danger of oxidation or fusion with the mercury.

Forming the stainless tubing into coils is done quickly and simply on a drum type tube bending machine. For two of its ignitron models, two sizes of tubing are used — 5/8-in.OD x 0.065-in. wall x 20-ft long and 3/4-in. OD x 0.065-in. wall x 28-ft long.

After the coils are wound and the ends formed, one end is closed by Tig (tungsten-inert-gas) welding. The coil is placed on a vacuum pump and evacuated, and after a suitable vacuum is obtained, clamped off and checked for air leaks.

During pumping, the coil temperature is raised from room temperature to approximately 1,472 F while the ignitron is being evacuated. The cooling coil is water tested at 125 psi.

No machining operations are performed on the stainless tubing during the entire fabricating process. Once the coil is wound and tested, it is Tig welded to cold rolled steel plates on the ends of the ignitron tube.

Copper water fittings are brazed to the stainless. A thermostat mount is brazed solidly to the cathode header and cooling coil to provide accurate temperature indication and tube protection.

GROOVED drum fixture mounted on a lathe is used to form Type 304L stainless steel tubing into cooling coil for welder ignitron.

World's toughest "lawnmower" welded with M&T Murex electrodes

Thicket, field, forest—all would be duck soup for this 16-ton husky. The first of its kind to be self-propelled, the Marden brush cutter can clear a seven-foot swath through dense undergrowth with trees up to 6" in diameter. And as it clears, it forces the vegetation into the ground to act as humus. In building its rugged brush cutters, the Marden Manufacturing Company uses M&T Murex dependable electrodes—products of METAL & THERMIT CORPORATION, General Offices: Rahway, New Jersey.

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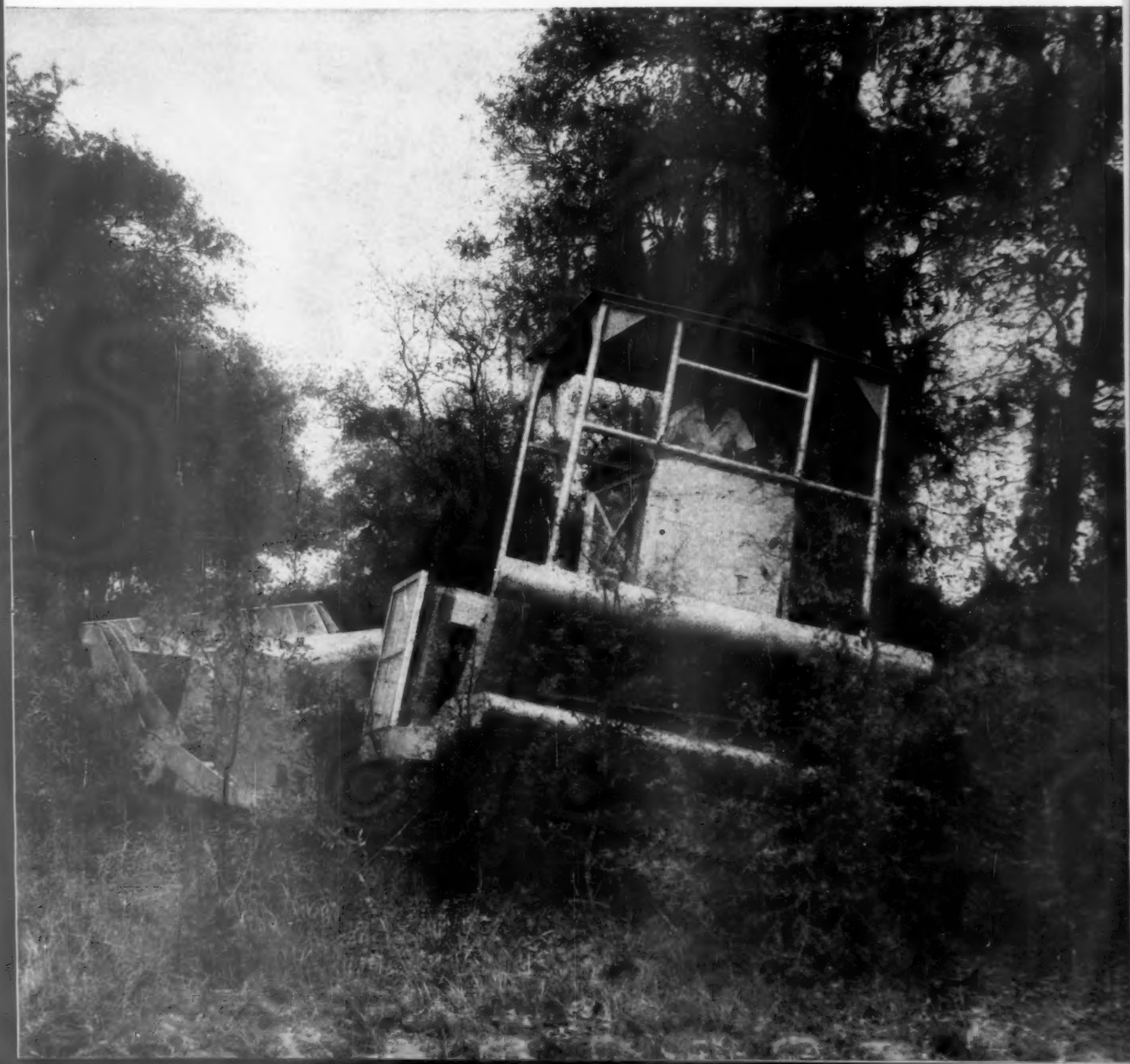

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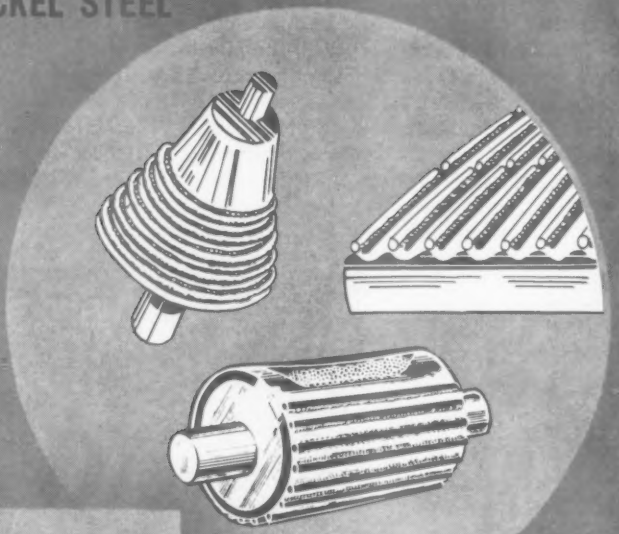

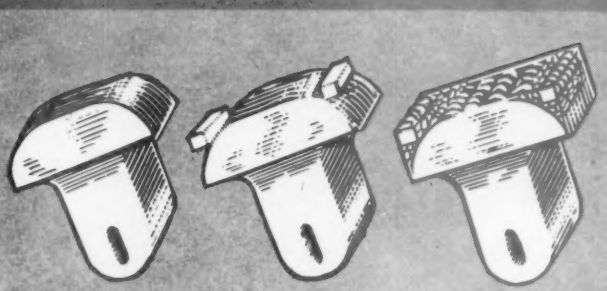

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Automation

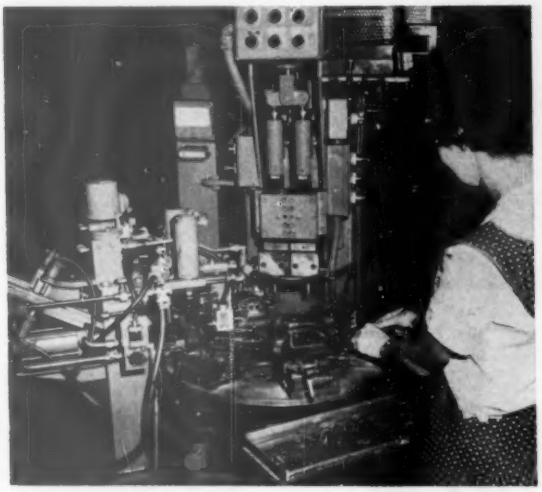
Automatic resistance welder keeps costs low

IN AN ERA of constantly rising prices, one of the few items which has managed to hold the price line is the ever-present electrical base plug. Not only have these outlets stayed relatively low in cost — their quality has improved.

One of the main reasons for this stability, of course, is that electrical equipment manufacturers have turned strongly to automation. Not only are hundreds of electrical components automatically stamped, formed and assembled, they are even handled in bulk, with the resultant savings being passed on to the customer.

Representative of the sort of automated equipment being adopted by electrical manufacturers are two resistance welders at the Bryant Electric Co., division of Westinghouse Electric Corp.

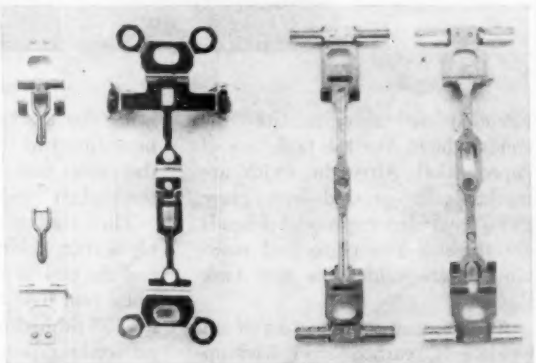
These 30 kva units in the Bridgeport, Conn., plant are both equipped with six-station Geneva dial feeds. Parts are drawn from hoppers, assembled, welded, formed in one case, and ejected automatically at a rate of 1,500 to 2,000 assemblies per hour.



DUAL head, dial feed resistance welder can turn out 1,500 to 2,000 assemblies per hour.

One machine welds support ears onto the ends of two styles of yokes for duplex electrical outlets. The other series welds spring-grounding contacts onto similar yokes, and does a forming operation on one style of yoke. The fixtures on the dial tables are designed to accept two styles of yokes without alteration.

These resistance welders are made by Precision Welder and Flexopress Corp., Cincinnati.



THESE are some of the parts welded automatically. One machine welds wire spring clips on parts at left, another welds ears on parts at right.

Colossal Crawler

Beautiful bridge

Mammoth "mower"

A tractor that shoves huge rocks and mounds of earth . . . a bridge that wins an award for beauty . . . a brush-cutting machine that clears dense undergrowth . . . all must be both carefully engineered and strongly built to do their jobs properly. It's significant that all were welded with M&T Murex electrodes.

On one important job after another, Murex electrodes have met the most demanding specifications. With more than 1000 types and sizes to choose from, you're almost *sure* to find a Murex electrode that exactly meets your requirements. Send for "electrode selector" booklet.

M&T MUREX welding products

METAL & THERMIT CORPORATION
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Circle No. 185 on Reader Service Card

Alloy provides rust-proof tanks

Copper-nickel combination welded in water heater production

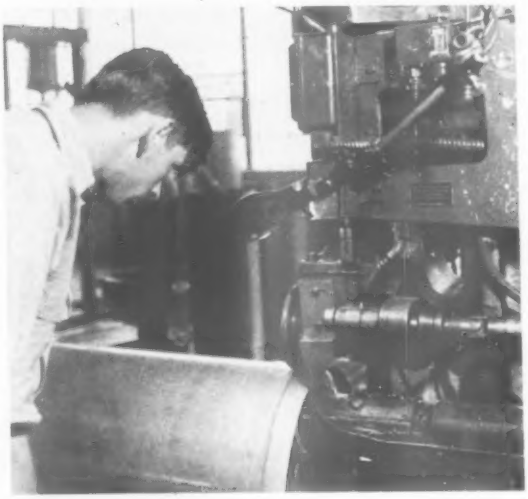
TANK cylinder is hydraulically expanded to true circle and size. Process also serves to relieve stresses locked up during rolling or welding operations.

ONE OF THE MOST urgent needs in home water heaters has been for a tough metal which resists rust formation.

Manufacturers have found the answer to that need in a copper-nickel alloy, developed by International Nickel Co., Inc., New York City, in conjunction with other metal firms.

The alloy, cupro-nickel, is a 90/10 combination, which blends the red of copper and the silver of nickel into a golden color. Engineers at Ruud Mfg. Co., Kalamazoo, Mich., a leading manufacturer of automatic gas water heaters, chose cupro-nickel as the alloy that possessed properties important in the design of vessels subject to pressure and thermal changes; pressure and changes which resulted in pulsation and the attendant potential of fatigue.

At Ruud, longitudinal seams for the tanks are flash welded with a 2,300 kva unit, utilizing a natural gas shield. For circumferential seams, a 400 kva resistance welder is used, with material ranging from 0.0375 up to 0.056 in. welded to 0.0525 up to 0.090-in.-thick material. Welds are water-shielded, with no special controls.



RIGHT — After pressing into place cupro-nickel head is resistance welded to tank shell.

Spud welds are made with a 300-amp d-c generator, straight polarity Tig torch. Welding current is approximately 100 amps.

Flash welding of the longitudinal seams is the second major step in the fabrication process. After welding, the tank cylinder is hydraulically expanded to true circle and size. This relieves any stresses that were locked up in the rolling or welding operations and also tests the soundness of the weldment.

Next, the location for tank openings are indexed, punched out and extruded to accommodate the spuds which, like the tank, are of cupro-nickel. After the spuds are mechanically pressed into place and Tig-welded, cupro-nickel heads are pressed into place and resistance seam-welded to the tank shell.

After a soap-solution test of all weldments, carbon steel back-up heads for mechanical strength are press-fitted to the alloy heads and the excess side sheet is curled over the carbon steel head.

Then the complete head assembly is spot welded to the side sheet and the tank is given a final hydrostatic test. The tanks are designed for 355 psi hydrostatic test and 150 psi working pressure.

At Kaiser Steel Corporation's Fabricating Division, a Model 30 Iriditron is used to spot-check plate welds on the bow section of a steel barge. Light and easily carried, requiring no outside power supply, the Model 30 uses iridium 192. It can take internal and panoramic exposures not possible with standard equipment.

Remote control of iridium... with Budd Iriditron units

- **Especially designed for remote handling of iridium 192**
- **Excellent for panoramic and internal exposure**
- **Permits exposure of iridium sources by remote control as far as 50 ft. away.**

Skid mounted or portable, this Budd Iriditron unit provides all the versatility of the traditional unshielded source for pipe weld radiography, panoramic exposure of multiple specimens, circumferential and longitudinal welds in boilers and pressure vessels. The unit can hold extremely strong sources . . . as much as 30 curies of iridium 192, approximately equivalent to a 260 KV X-Ray machine. This adds up to significant reductions in exposure times.

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For more facts Circle No. 186 on Reader Service Card

Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Techniques for torch brazing aluminum

Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding

Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability

Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

Tungsten inert gas

A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals

Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene

A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing

Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. This reprint is free.

Selection, welding of CrMo alloy steel pipe

Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

How to select proper regulators

Performance characteristics of equipment controlling gas flows during welding, cutting and other operations are given, as well as selection rules.

Filler metals for joining

Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls

Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture

Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed. This reprint free.

Explosive welding and forming open another door

A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology

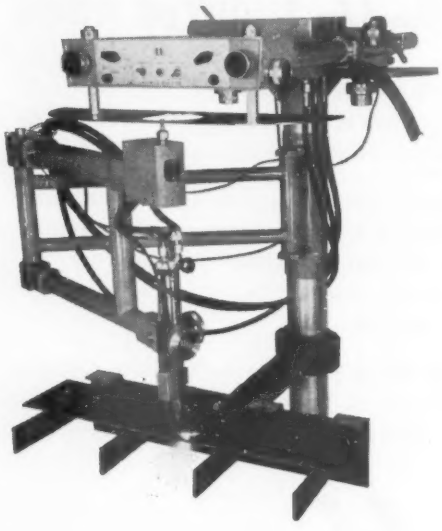
A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage

Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.

with a Heath Ultra-Graph

Unit cost is reduced by flame cutting slots and holes



Requirements called for a slot 7/8" wide by 6" long in 14 Ga. rectangular steel tubing. Flame cutting with an Ultra-Graph Guidance Machine produced a sharp, clean cut to specified tolerances, reducing process time by more than one half over a machining operation. Presently units with access and mounting holes, coin slots, keyways, and grooves are produced at less cost because stamping and machining operations have been replaced by flame cutting with a U-G machine.

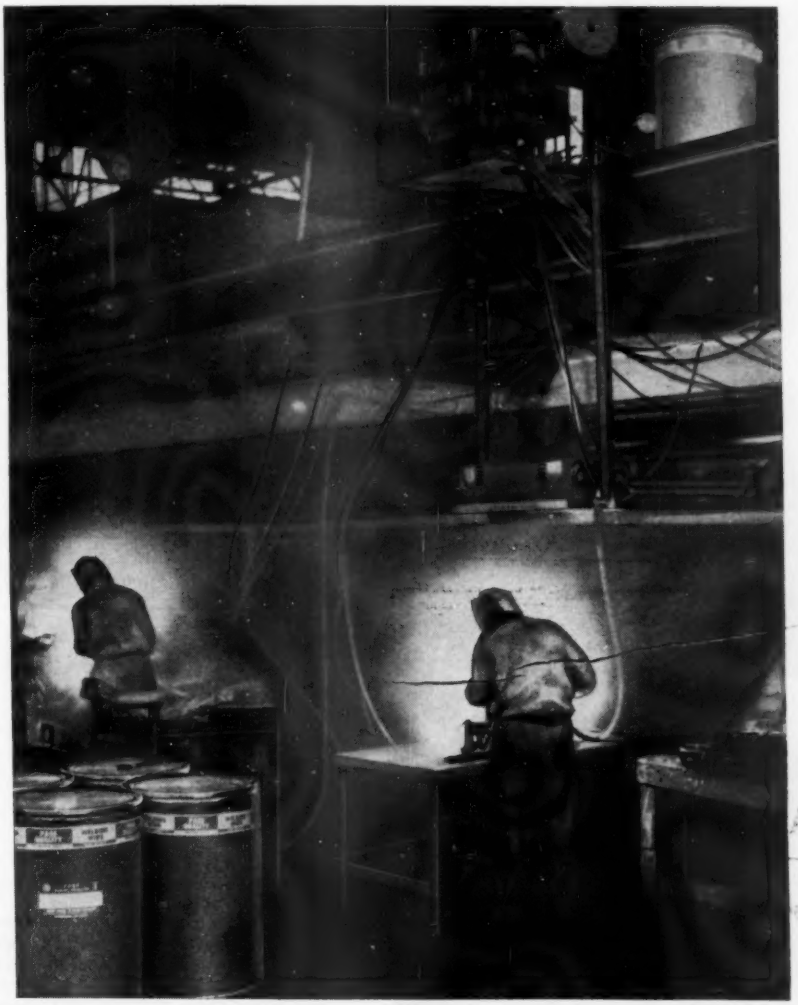
SERIES 460 ULTRA-GRAPH

Send for information on Ultra-Graph Guidance Machines for application to flame cutting or welding. See your Local Welding Supply Dealer for a demonstration.

HEATH ENGINEERING CO.

168 AULT ROAD
FORT COLLINS, COLORADO

On production line welding at Parish Div. of Dana Corporation



UNIFORMITY OF PAGE WIRE CUTS DOWN-TIME

500# Payoffpaks of PAGE welding wire provide continuous feed with no down-time for reel or coil changeovers at Parish Pressed Steel Division of Dana Corporation. Those shown above, for instance, feed CO_2 welding machines used to produce motor mount members of automobile frames.

As a major automotive supplier, Parish demands uninterrupted production of extremely high quality. Parish specifies PAGE welding wire not only because they can get the correct wire analysis, but also because PAGE wire offers uniform temper and finish plus consistent metallurgical characteristics. These factors, combined with the right packaging, help Parish maintain quality, minimize down-time.

Let PAGE help solve your welding problems • From PAGE, you get over half a century of wire drawing experience and leadership in metallurgical research. From 33 welding wire analyses, PAGE can furnish the right wire for your job. Every modern form of packaging is available for convenient storage and handling. Prompt delivery is assured by a coast-to-coast network of PAGE distributors and warehouses. Bring your welding problems to PAGE—we'll be glad to help you improve your quality and lower your production costs.

These Folders can help you

Write for:
Folder DH-402-C
Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

ACCO

PAGE WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.
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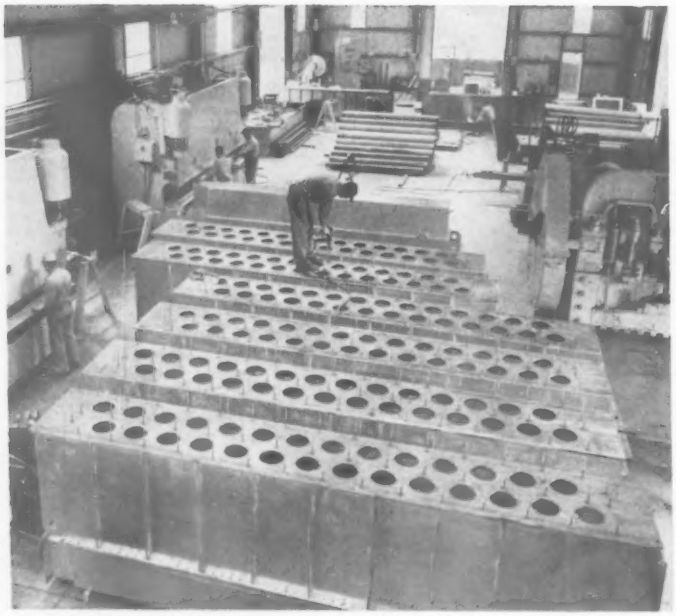
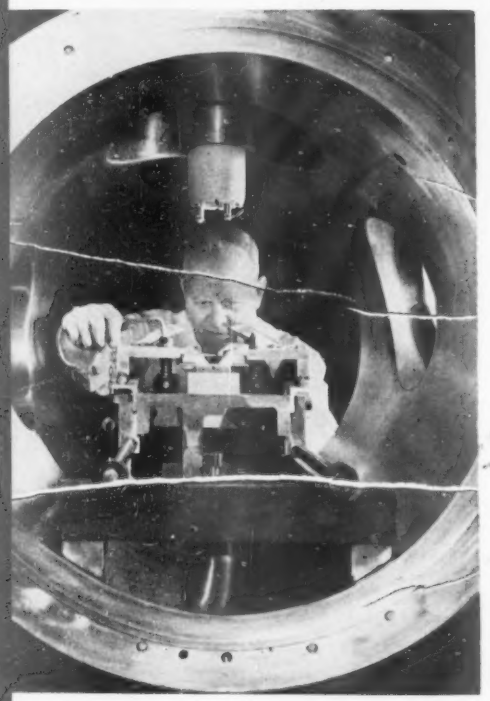
*Indicates PAGE warehouse stocks

PAGE—*THE SOURCE FOR ANSWERS TO WELDING PROBLEMS*

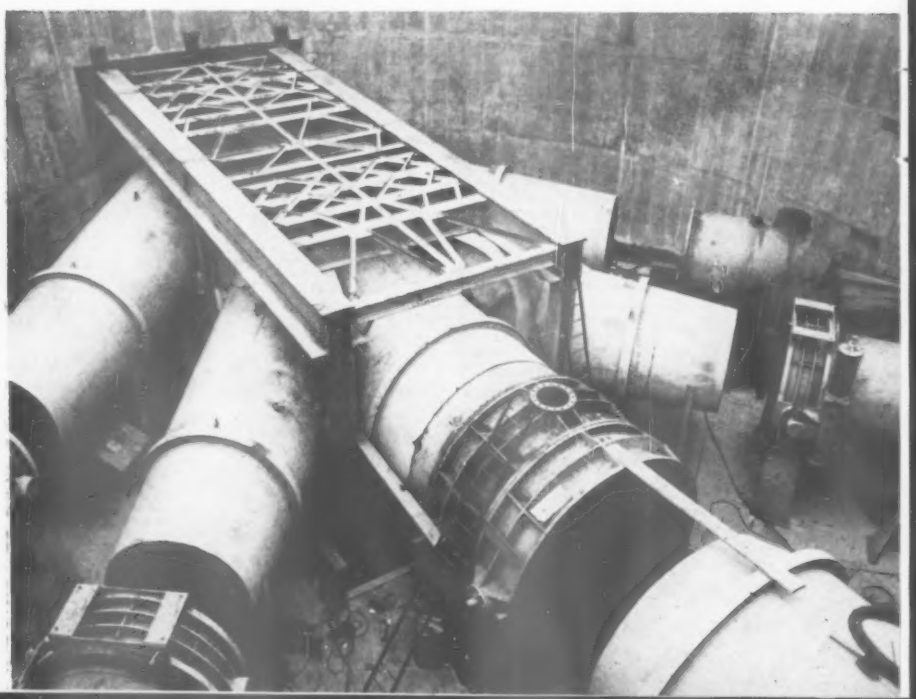


END-WELDED studs, used to connect flanges and to secure insulation, are applied during fabrication of metallic tube recuperators at Hazen Engineering Co., Pittsburgh. The studs, either ½-in. or ⅜-in. in diameter and from 1- to 6⅝-in. long, are applied twice as fast as other fasteners, according to their manufacturer, Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio.



On the Job...

CONCENTRATING a beam of electrons to create temperatures of 6,000 F permits joining of two pieces of "space-age" metal in deep-penetration, narrow-bead welds. In actual operation the chamber is sealed at each end, and a vacuum maintained to assure contamination-free environment. Here, technician of Republic Aviation Corp., Farmingdale, L. I., N. Y., positions pieces preparatory to the automatic operation.



HUGE header pipe and Y-connection, produced by Steelweld Div., R. C. Mahon Co., Detroit, are ready to be hooked up to four pumps, with the 37-ton frames in place. To be installed at Detroit's Waterworks Park raw water booster pumping station, the pipe is part of an effort to increase screened raw water supply to Springwells and Northeastern water treatment plants. Installation here rests on a "platform" inside the 90-ft-deep caisson.

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BACKING RINGS

SIMPLIFY
PIPE WELDING IN ADVERSE FIELD CONDITIONS

FAST•EASY•FIT-UPS

TYPE CCC

Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB automatically sets root gap. ROBVON rings are beveled to assure non-restricted fluid flow.

TYPE CC

Designed to allow quick easy alignment of pipe where the inside diameters are slightly out of round. The welder has the choice of "STRIKING OFF" the NUBS or leaving them intact to be melted into the weld mass of the first roof pass.

TYPE C

Designed for precise close tolerance fit-up. Type "C" NUBS automatically sets root gap. The NUBS melt with the metal to give complete penetration and fusion.

PLAIN TYPE

Rings have flat outer surface with beveled internal edges and flat inner land.

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To help you know the line and select the alloy and flux best suited for each job, All-State publishes a 56-page INSTRUCTION MANUAL, free to interested users. Also, a special ALUMINUM MANUAL containing 36 pages of data on aluminum alloys and how to join them. If you work with aluminum, ask for a copy.

To serve you, All-State maintains 3 factories, 4 warehouses (White Plains, N. Y.—St. Louis, Missouri—South Gate, California—Toronto, Ontario, Canada) and a central Technical Department and Laboratory at headquarters.

ALL-STATE WELDING ALLOYS CO., INC.
WHITE PLAINS, NEW YORK

Circle No. 190 on Reader Service Card

All-welded yacht competes in 800-mile race

DYNA, THE WORLD'S first all-welded aluminum racing yacht, recently took part in this year's 800-mile run from Newport, R. I. to Bermuda.

Designed several years ago for owner-skipper Clayton Ewing, Dyna was the subject of a WELDING ENGINEER feature in April, 1958 (p. 42).

In fabricating the sleek, swift yawl, weldors at Burger Boat Co., Manitowoc, Wis., found that 1/16-in. wire in a water-cooled gun was the best way to Mig weld the 5154 aluminum flat bars, 2½- x 3/8-in.-thick.

First part to be welded was the skeleton framing: 50 transverse and longitudinal supports were connected. Then 60 ¼-in.-thick aluminum plates were fillet welded to the ribs to form the hull. Fillets ranged from 5/16 in. to 3/8-in. in size.

A standard 300-amp d-c welder supplied the power, with an average setting of 200 amp. Approximately 30 cu ft of 100% argon was consumed each hour of welding.

The nearly 20,000 lb of aluminum, supplied by Aluminum Co. of America, Pittsburgh, in her hull, spars, and fittings, make Dyna much lighter than comparable conventional crafts. The hull alone, for example, is 9,700 lb lighter that it would be had it been made of steel, 8,200 lb lighter in the case of wood.

NAVIGATOR Wallace Donker steadies aluminum mizzenmast as masts are stepped in preparation for 800-mile race.

SLEEK Dyna measures 57 ft, 5 in. in overall length. Here she is berthed at the Mid Hudson Marina, Kingston, N. Y., for pre-race work.

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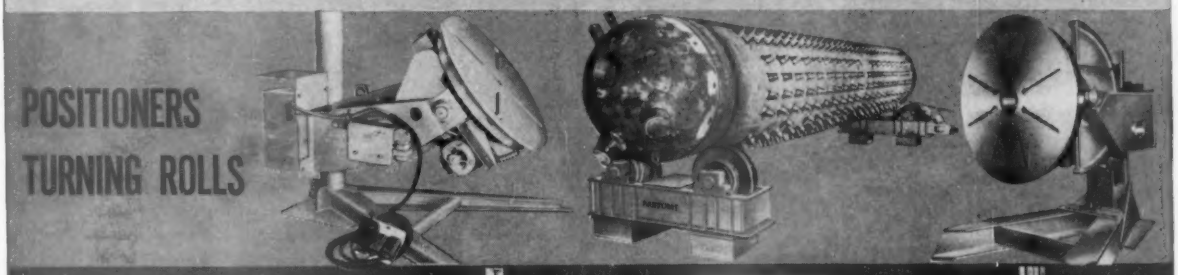

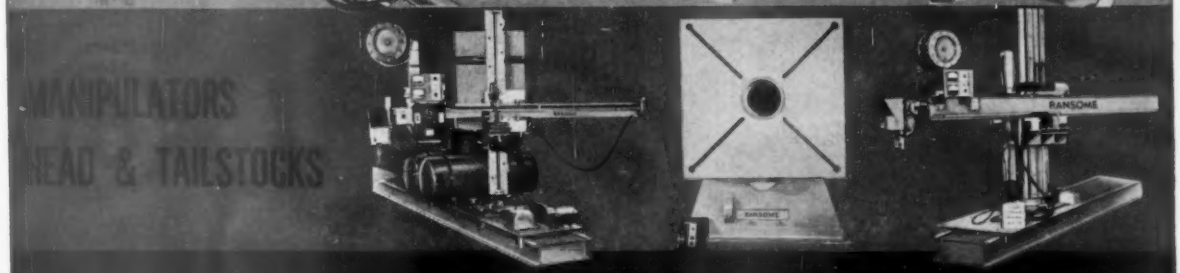

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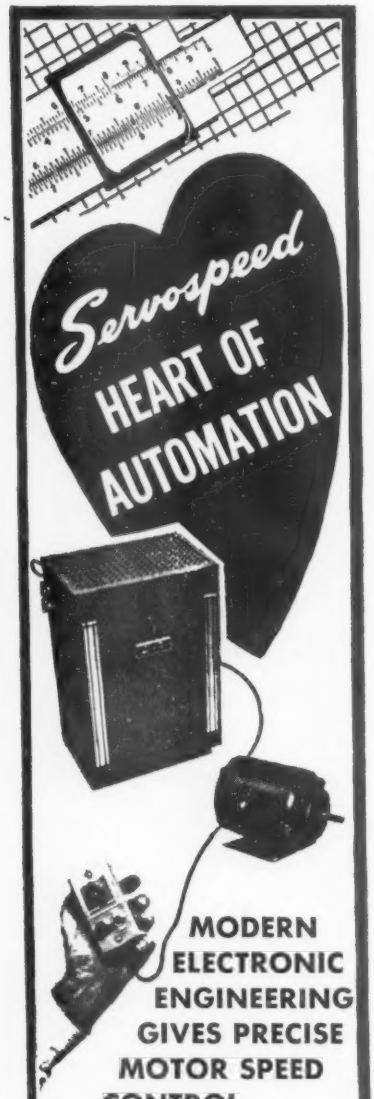

MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

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Metal spray solves many surfacing problems

FROM AN UNSUCCESSFUL experimental method to the forefront of current metal reclamation processes — that is, briefly, the history of metallizing.

The idea of spraying metal parts with metal particles was conceived before 1933, but it was not until World War II that the process, like so many others, was improved and put to work on a major scale.

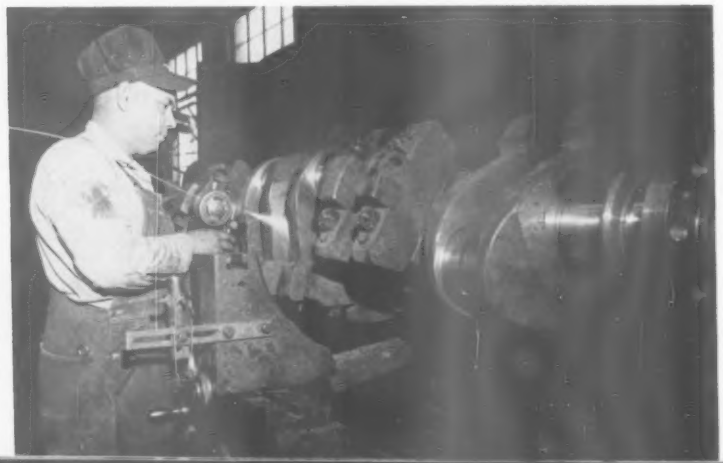
In 1948, Metallizing Engineering Co., Westbury, N. Y., introduced a special surface preparation for metallizing applications. Essentially pure molybdenum, it bonded even to highly polished surfaces, and proved to be an excellent surface for bearings. On the heels of this invention came development of a spray gun suitable for work in small shops, thus enlarging the potential market for this type of process.

Later developments went even further in allowing adaptation of the spray method to resurfacing problems: a special gun was made for spraying extremely hard metals (such as tungsten carbide) and powdered ceramics. High speed guns for hand use and lathe mounting were next followed by an electronic metallizing machine designed for automatic production line operation.

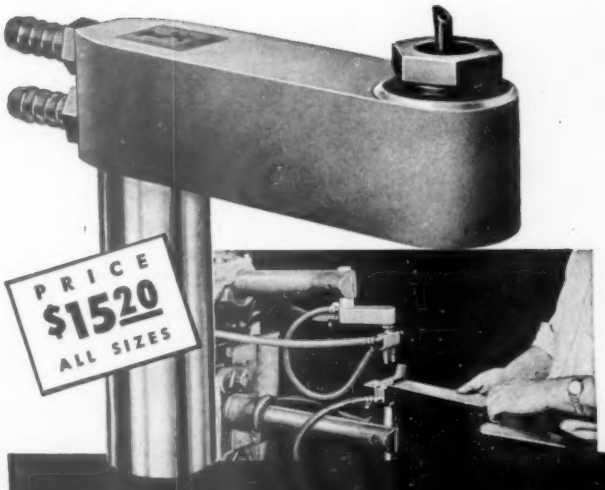
In application, the process is quite simple: metal, in wire form, is drawn through the nozzle of a gun, where is it melted in an oxygen-gas flame and atomized by a blast of compressed air. The ensuing particle-spray is directed at the work surface, and maintained until the desired build-up is achieved.

Any metal can be applied over any other. Frequently, a mild steel part is coated with a harder substance — stainless, for example. In many cases it is possible to metallize parts before installation. There is no danger of heavy crystallization or distortion, according to Metallizing Engineering, since the metal sprays on nearly cold.

PUMP plunger is sprayed with metal alloy in powder form.



METALLIZING is employed here on a large diesel crankshaft. Stainless steel buildup will provide harder surfaces than original for protection against abrasion and corrosion.



NEW All-Aluminum Offset Holder

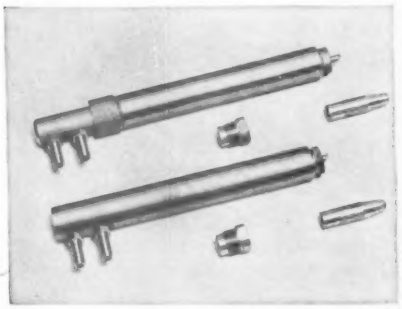
You'll pay less for this new TUFFALOY offset holder—and get more benefits too. Only a complete departure from previous manufacturing methods could come up with this low-cost, high quality holder (each holder is a 'slice' of a giant aluminum extrusion).

These light weight, corrosion resistant holders carry threaded tip adapters that take the brunt of the wear, always encountered in the tip socket. To change tip size from a 4 RW taper to a 5 RW taper (Nos. 1 & 2 M.T.), you change adapters, not holders. Standard 2- and 4-inch offsets, with shank diameters of ¾, ⅞, 1, 1¼, & 1½-inches.

NEW LOW-COST OFFSET SPOT WELDING TIP HOLDERS

NEW Simplified Paddle-Type Holder

Simplified design makes this new TUFFALOY paddle-type holder both lower in cost to use (no tee connector is needed) and more rugged and long-lived. An outstanding holder for spot welding in restricted areas. Standard 4-inch offset, with shank diameters of ¾, ⅞, 1 & 1¼-inches. It uses TUFFALOY Socket-Type Tips, available in four nose types. They can be inserted on either side of the paddle.



New this year are these Tuffaloy straight holders: The Goldcrown ejector type (top), and the Goldspot non-ejector type (bottom). The ejector holder features an entirely different method of ejecting tips. The sturdy brass head is moved forward, forcing a stainless steel ejector tube against the base of the tip. This mechanism *does not cause leakage*, usually associated with ejector holders.

Threaded adapters eliminate the need for reworking worn tip sockets, permit changing tip size without replacing the holder. In 8- and 12-inch lengths and in diameters of ⅞, 1, 1¼, & 1½-inches. For Nos. 4, 5, 6, & 7 RW taper tips.

Request the new TUFFALOY Catalog. It describes for the first time the RW Taper numbering system for spot welding electrodes.

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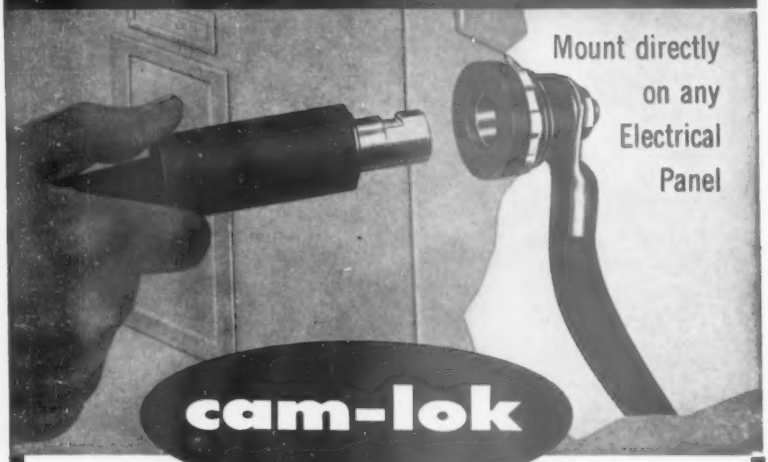
New Hi-Impact Plastic Insulated

Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

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Stud welding saves Ohio firm $1 per unit

SAVINGS OF A DOLLAR per fastener were realized when small end-welded studs were substituted for cap screws in an application at the Galion Iron Works and Mfg. Co., Galion, Ohio.

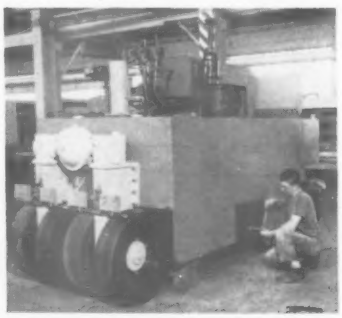
Whereas the studs cost six cents apiece, the fastening method they replaced came to something over a dollar per unit, according to the plant superintendent.

Ten threaded studs, 3/8-in. in diameter and 1-in long, are now used to secure each of two gasketed cover plates on Galion's 12-ton pneumatic tire roller, used for compacting construction surfaces.

The studs are welded with a gun manufactured by Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio. Formerly, welding pads had to be manually arc welded to provide tap depth, since the roller's frame is only ¼-in. thick.

ABOVE — Studs are welded through template at rate of four per minute.

BELOW — Cover plate on pneumatic roller is adjusted.



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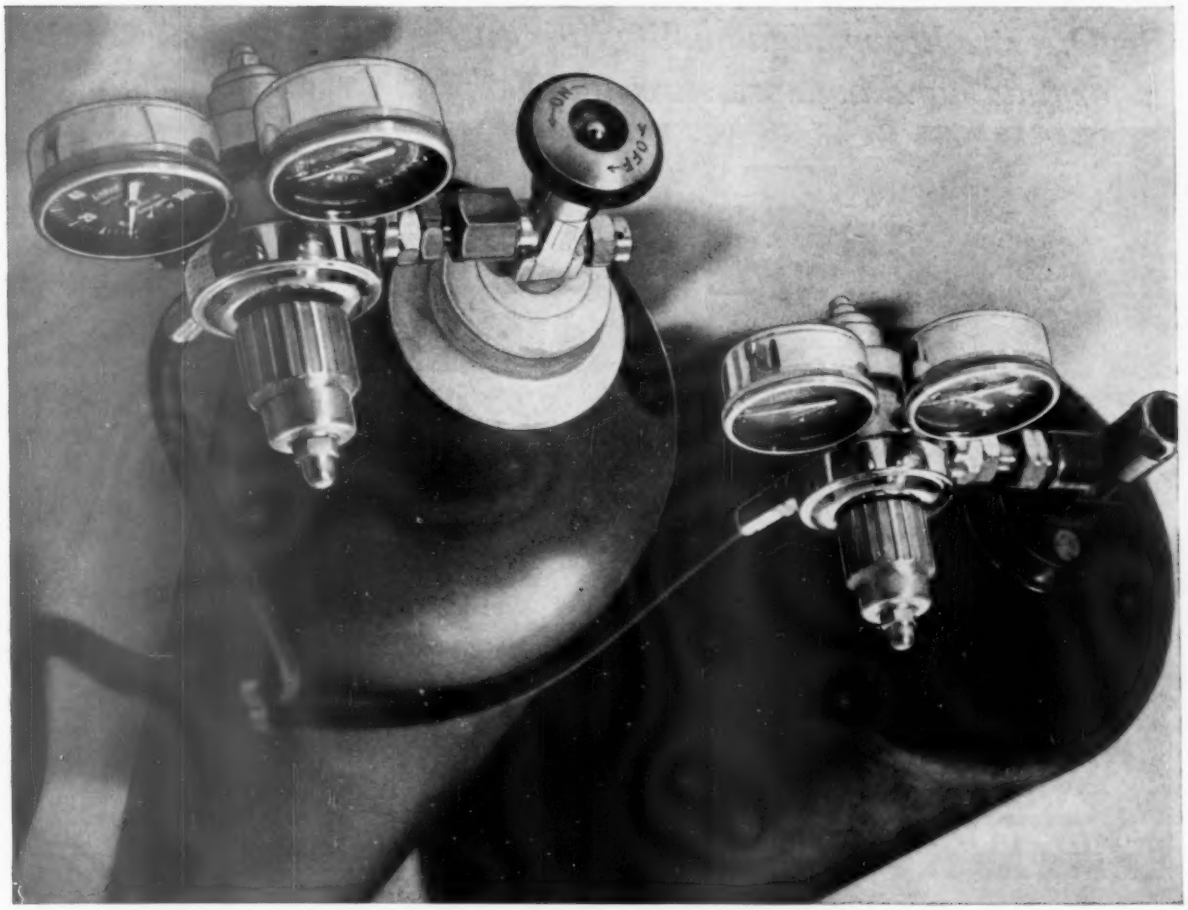

no other regulator is so easily adjusted, none are safer. and, no other regulator offers greater user satisfaction . . .

New and better equipment, in every industry, makes every job safer and easier to accomplish. Modernization is the keystone to all of our amazing industrial progress.

We too, in our old established company, are constantly striving to bring better products to our many customers.

If you are yet among those who have not tried NATIONAL of CALIFORNIA regulators, we can promise you a thrill; for no other pressure reducing regulators are so well made, function so flawlessly, operate with greater safety or stay on the job longer. Why not try them? They are good.

made for all high pressure gases —both single and two stage

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All items are made in strict accord with industrial specifications, carefully cleaned for oxygen service.

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Liquid flux system repairs propellers

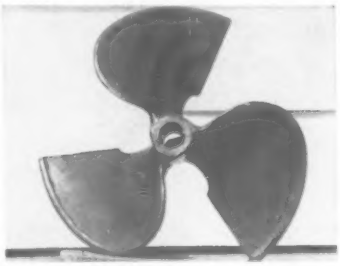
TYPICAL OF MANY shops set up to repair and rebuild worn propellers —the bane of boat owners and operators on Northwest rivers, lakes and ocean waterways—is Gillette's Marine Ways, Samoa, Calif.

Like most marine repair shops, Gillette relied on arc welding with mild steel on steel propellers or brazing with bronze rods on brass components, in both cases using standard powdered flux.

Results were not entirely satisfactory: the flux did not get to the bottom of the pits on bronze. This prevented a good bond, and resulting welds were porous. The arc process worked better on steel, but was painstakingly slow, hence, much more expensive.

Granville Gillette, the firm owner, tried a liquid flux system on recommendation.

Results proved excellent; the liquid flux penetrated to the bottom of the pits in corroded propellers, and floated oxidized metal



PROPELLER blade after build-up using nickel silver rod.

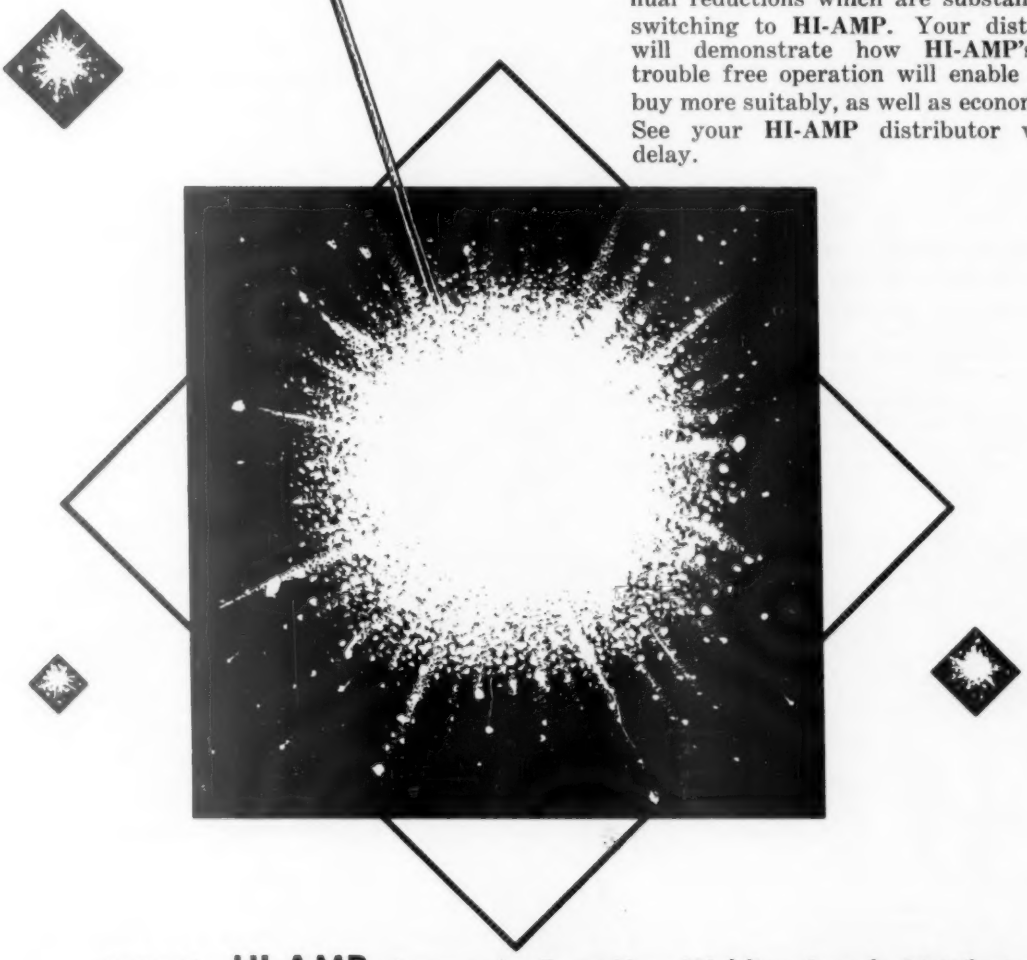
particles and dirt to the surface where they could be removed by grinding. Nickel silver rod, also recommended by the supplier, and, like the flux, manufactured by All-State Welding Alloys Co., Inc., White Plains, N. Y., proved easy to handle and machined well.

The firm additionally found that the weldor had much better control of the bronze fillet on the thin edges of blades, and that it was possible to run a smoother and thinner bead due to elimination of rod dipping. Gillette estimated his savings in materials at 20% on each job, not including reduced job time.

Having Welding Troubles?

ASK FOR TROUBLE FREE HI-AMP

Profit-conscious companies from coast to coast have discovered that trouble free **HI-AMP** electrode holders and accessories cost them less, while serving them better. Many purchasing agents have effected annual reductions which are substantial by switching to **HI-AMP**. Your distributor will demonstrate how **HI-AMP's** cool, trouble free operation will enable you to buy more suitably, as well as economically. See your **HI-AMP** distributor without delay.



Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

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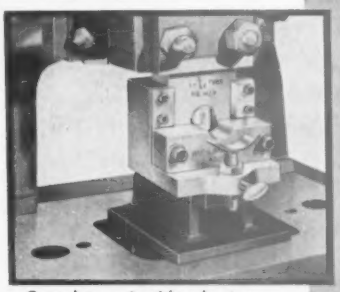
NOTCH 12 PIPE ENDS per MINUTE with ARC-FIT®

Mounted in hand press with portable stand.



Complete unit with adapter mounted in punch press.

Pipe, tubing and shapes notched with Arc-Fit units.

ARC-FIT notching makes perfect joints for welding or brazing.

The Arc-Fit cuts clean contours for "T" joints in seconds . . . without deformation . . . no finishing is required. Mounted in hand or power press it readily notches 12 pipe ends per minute . . . 750 per hour.

A standard Arc-Fit with easily interchangeable dies (one for each contour) notches pipe ranging up to 2" O.D.; or tubing up to 2⅜" O.D. Special Arc-Fits are available for larger sizes, angles other than 90°, slotting, notching square pipe and for angle iron or flat stock.

Ask for literature. For quotation send sample or drawing of part.

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This press lets you notch standard pipe or tubing — upwards of 1000 pieces per hour. It was especially designed to accommodate the Vogel Arc-Fit unit (above) and is very simple and economical to operate. Press comes mounted on a sturdy stand (less Arc-Fit unit) but is otherwise complete and ready to operate when connected to your air line.

Operating on a minimum of 75-100 PSI pressure this press will notch pipe ranging up to 2" standard pipe and up to 2⅜" maximum O.D. tubing. For complete information write or phone —

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Gas cell is promising fuel source for explosive forming

AN EXPERIMENTAL ELECTROLYTIC gas cell generating an oxygen-hydrogen mixture is a promising fuel source for explosive metal-forming operations and high-temperature welding and cutting torches, according to scientists at Battelle Memorial Institute, Columbus, Ohio.

When exploded, the gas mixture creates pressure ten times greater than the starting pressure, which is limited only by the strength of the container.

For example, a 1,500-psi mixture on a 2,000-sq-in. working surface would produce a peak explosive force of 15,000 tons when ignited. Possible applications include forming large sheet parts used in the aircraft and missile industry.

The generator, reports Battelle's Dr. John McCallum, consists of a number of flat nickel-plated steel electrodes placed 6.060-in. apart in a plastic or insulated-metal container holding a weak caustic solution. Current is run into the two outside electrodes with the intermediate ones functioning as bi-polar electrodes.

According to Dr. McCallum, an oxy-hydrogen mixture of approximately 8 to 1 by weight produces the highest flame temperature, fastest detonation, and greatest increase in pressure when ignited. Estimated cost of producing the gas is 10 to 30 cents per 100 cu ft, depending on electric power costs.

Using gas for explosive forming operations may provide some advantages over conventional methods. When solid or liquid explosives are used, pressures of millions of pounds per square inch form the metal within a few microseconds. Shock waves are reflected and reinforce the next wave, sometimes doubling the impact and causing the workpiece to crack.

In contrast, gas explosions produce pressures up to hundreds of thousands of pounds per square inch lasting several milliseconds and have a different shock pattern.

AROUND

General Cable's rubber-insulated welding cable is so flexible you can run it almost anywhere. It provides excellent resistance to abrasion, twisting, impact, heat, moisture and weather. Our neoprene-insulated welding cable extends this durability by also resisting flame and oil. And for really heavy-duty use, our Super Service welding cable combines unusually-fine strand construction with a heavy-duty, mold-cured neoprene insulation-jacket. This Super Service type complies fully with all of the applicable IPCEA standards. General Cable also manufactures a superior Welder Power Supply Cable to complement its regular line of welding cables. Call your authorized General Cable Distributor for full information.

GENERAL CABLE CORPORATION

730 Third Avenue, New York 17, N.Y. ■ Offices and Distributing Centers Coast-to-Coast

For more facts Circle No. 199 on Reader Service Card

PRECISION READOUT FOR PRECISION ULTRASONIC MEASUREMENTS

The *Sonoray*® Caliper permits direct readings of flaw-depth and work-piece-thickness with absolute accuracies of a few thousandths of an inch, the relative accuracy increasing with thickness. Thus the ultrasonic-pulse *Sonoray*®, pre-eminent for flaw detection, can now be used additionally for high-precision measurement of thickness.

Sonoray's extreme horizontal linearity gives 1:1 correlation between distance and CRT indication. Calibration is quick and easy. The Caliper's hairline accuracy gives direct, positive, repeatible readings on a scale calibrated in 0.001 inch.

If *you* want to profit by extended use of your *Sonoray*®, write for Bulletin *T-208* on the Caliper. If you do not yet own a *Sonoray*®, ask also for Bulletin *T-200* on this remarkable instrument. For specific suggestions, outline your problem.

Since 1946—The Respected Name in Ultrasonics

Branson INSTRUMENTS, INC.

59 BROWN HOUSE RD., STAMFORD, CONN.

Circle No. 200 on Reader Service Card

October's Headlines . . . from page 8

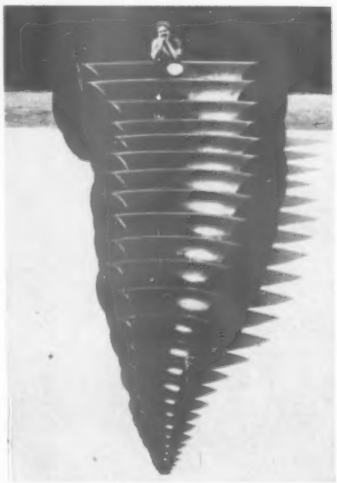
HEAVIEST pipeline fittings of their kind ever made, according to Tube Turns division of Chemetron Corp., Louisville, these 7-ton pig diverter laterals are to be installed in 116-mile run of 34-in. gas line in the California desert.

New hydraulic equipment firm organized

A new firm, Fluidline Engineering, Inc., Chicago, has been formed to take over operations previously handled by a division of the Wallace Supplies Mfg. Co., Chicago.

Frank Lammers and Arnold Johnson, formerly executives with Wallace, are owners of the new hydraulic equipment firm.

Wallace's board of directors recently decided to devote the firm's full attention to cutting and bending machinery.



THERE are 27 elbows in this picture — count them if you doubt it. (But don't forget to include those of the girl at the top.) Line-up of forged steel elbows ranging from ½-in. to 42-in. sizes for industrial piping and pipeline systems was displayed during Family Day at Tube Turns.

THIS 600-volt electrical switchgear incorporating a conductor system of welded tubular aluminum bus represents a new use for aluminum electrical bus conductor. Built by The Wolfe & Mann Co., Baltimore, the switchgear was recently installed at the Vernon, Calif., works of Aluminum Co. of America, Pittsburgh.

Welded tube used for school building framework

A unique application of rectangular tube is to be found at the Haverstraw, N. Y., Elementary School, where 4-in. x 2-in. steel tubing has been welded into a 22-ft-high framework that will compose a large section of one end of the building.

The framework, made of tube manufactured by Republic Steel Corp., Cleveland, will "house" glass-and-metal window and door units and join two walls of brick.

Titeflex, Inc., Meets Aircraft Fuel, Lubrication and Hydraulic Line Specifications with

HANDY & HARMAN BRAZE 541

Titeflex operator brazes assembly with torch and hand-fed Handy & Harman Alloy BRAZE 541. *Titeflex is unique in that it makes flexible hose assemblies from raw material to end product—"From End to End, Inside and Out, made RIGHT In Our Own Plant."*

This Springfield, Massachusetts, manufacturer of aircraft and missile fuel, lubrication and hydraulic lines finds that silver alloy brazing with Handy & Harman BRAZE 541 meets rigid operating requirements "all the way down the line."

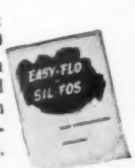
The tubing and fittings of many of the wide range of assemblies made by Titeflex are 321, 316 and 347 stainless steel and Monel. Brazing is a hand torch, wire and HANDY FLUX operation.

BRAZE 541 is a plastic alloy which melts at 1325° F and flows at 1575° F. Its strength—in shear—at elevated temperatures is 21,500 psi at 500° F and 15,000 psi at 750° F. This alloy's ductility in resisting stress and vibration is very high and its resistance to oxidation and corrosion is equally impressive. The composition of BRAZE 541 is 54% silver, 40% copper, 5% zinc and 1% nickel. It meets AMS Specification 4772.

Aircraft and missile component manufacturers and fabricators are finding—to their and their products' benefit—that Handy & Harman silver alloy brazing is the full and *final* solution to their metal-joining problems. BRAZE 541 is but one of a large family of Handy & Harman alloys, for both low and high temperature applications. We would like to more fully acquaint you with BRAZE 541 and with the advantages that come naturally to silver brazing as a metal-joining (both ferrous and nonferrous) method. Handy & Harman, 82 Fulton Street, New York 38, N. Y.

FOR A GOOD START:
BULLETIN 20

This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.



Your No. 1 Source of Supply and Authority on Brazing Alloys

HH

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

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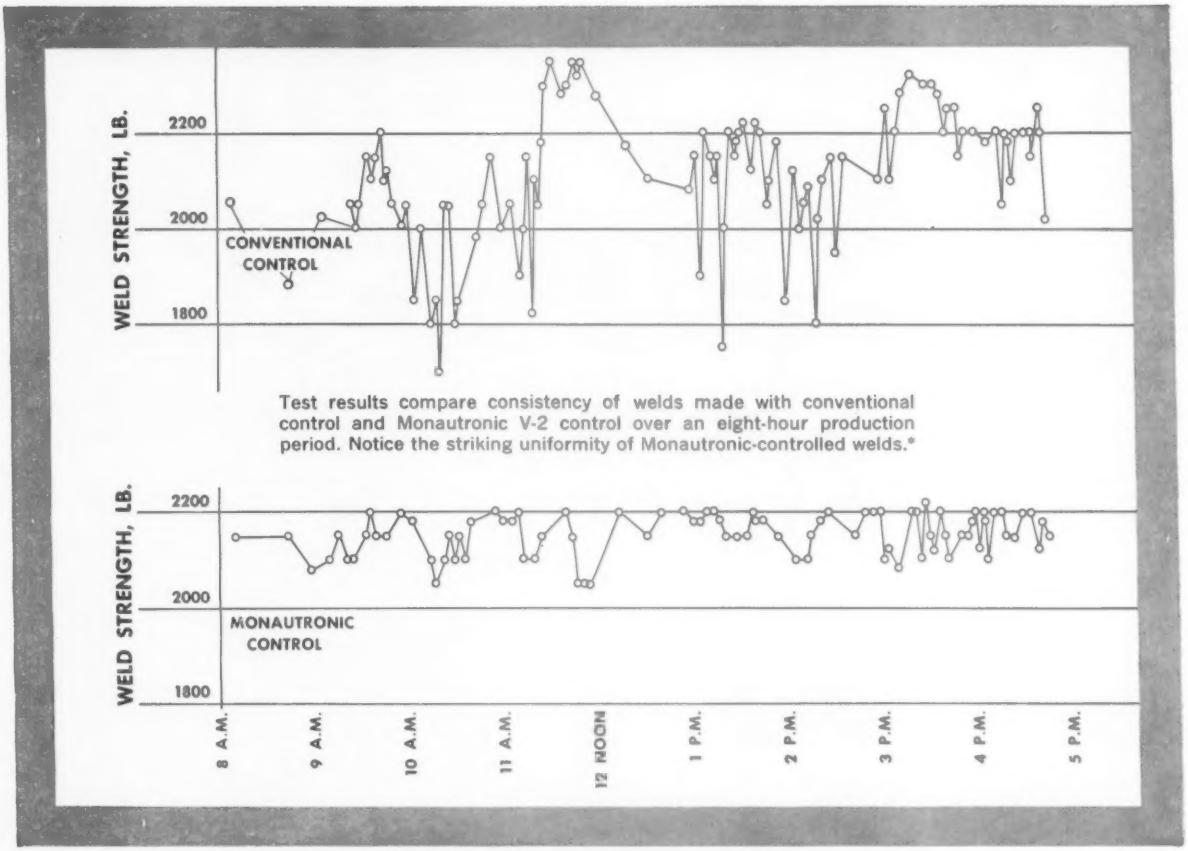
For more facts Circle No. 201 on Reader Service Card



Test results compare consistency of welds made with conventional control and Monautronic V-2 control over an eight-hour production period. Notice the striking uniformity of Monautronic-controlled welds.*

new feedback control gives you consistently high quality welds . . . automatically

Monautronic V-2 welding control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

The new *Monautronic V-2* welding control makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The control compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures uniform production of high quality welds.

Any metal that can be resistance welded can be welded better with the Monautronic V-2 than with any other control on the market.

For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

*Case study upon request.

2450 Hunting Park Ave. Philadelphia 32, Pa. ■ 12141 Charlevoix Ave. Detroit 14, Mich. ■ 3050 East 11th St. Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

IN SUMMARY...

A four-day clinic at Stevens Institute of Technology was recently organized for 23 of its field supervisors and regional sales managers by **Eutectic Welding Alloys Corp.**, Flushing, N. Y. The clinic, aimed at giving the participants insight into the psychology of selecting and training men for better customer service, included a full daytime and evening schedule of lectures, seminars and discussions . . .

Diamonite Products Mfg. Co., Shreve, Ohio, lately completed new manufacturing facilities with 12,500 sq ft of added floor space (see cut) . . . **Thermo Electric Corp.**, Dubuque, Iowa, has changed its name to Thermolyne Corp. . . . A $1 million expansion of **Air Reduction Pacific Co.'s** new air separation plant at Richmond, Calif., will boost the installation's rated capacity to more than 65 tons per day of gas . . .

A 191-ft-long automatic wire fabric welding machine, delivered recently to **Keystone Steel & Wire Co.**, Peoria, Ill., by **National Electric Welding Machines Co.**, Bay City, Mich., is said to be capable of producing wire mesh at the rate of 60 tons a day. Reported to be the largest machine of its type ever built, the unit will turn out mesh up to 17-ft wide . . .

German X-ray technicians used **Gevaert Co.** (New York City) industrial X-ray film to inspect the oxyacetylene welds on a huge pipeline linking the North Sea to the Ruhr. The steel line – about 235 miles long – transports oil from the seaport of Willemshaffen to the big oil refineries inland . . .

(Continued on next page.)

FREE...for you!

Tips of the Trade from Blackhawk

Send today for your free copy of "Hydraulic Tool Ideas" — Blackhawk's colorful new how-to-do-it booklet for welding and fabricating. It's jam-packed with time-saving, cost-cutting ideas you can use right now! Ideas like these . . .

- What to do when a production run is too small for press brake tooling, too big for "bellows and anvil" methods;
- How to solve that ever-present problem of heat distortion after welding;
- How to fitup heavy metal components for tacking;
- How to design your own low-cost fixtures for welding complex assemblies.

For your complimentary copy of this valuable booklet, just send a postcard or the coupon to Blackhawk Industrial Division, Dept. WE, Butler, Wisconsin.

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RUSH my free copy of "Hydraulic Tool Ideas"!

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City ..... Zone..... State.....

BLACKHAWK INDUSTRIAL DIVISION

BLACKHAWK MFG. CO.

Aurora Welding Service, Inc., Aurora, Ill., has been purchased by H. B. Van Cleve, Jr., of West Chicago and Darrell Stephens of LaGrange, Ill. The new management is reorganizing its services in conformance with an expanded sales program of **Air Reduction Sales Co.**, New York City, for which it is a distributor.

Weltronic Co., Detroit, has opened a new Canadian division at 3201 Marentette Ave., Devon Park, Windsor, Ont. . . . **Premier Industrial Corp.**, Cleveland, recently formed a subsidiary in Toronto to market the company's industrial maintenance products and provide related technical service. Products of a third division which supplies welding rods, electrodes and other welding maintenance materials, and a fourth division being planned, will be added to the subsidiary's services . . .

Welding fittings and flanges for petroleum, chemical and other industrial piping are now being manufactured in Mexico City by **Tube Turns de Mexico, S. A.**, subsidiary of **Chemetron Corp.**, Chicago. Initial production at the Mexico City plant is in ½- through 12-in. pipe sizes . . . **Linde Co.**, New York City, recently officially dedicated its new Ribbonrail welding plant at Harrisburg, Pa. The new facility is currently welding standard 39-ft lengths of rail for the **Pennsylvania Railroad** . . .

Keystone Engineering Co., Los Angeles, recently acquired a controlling interest in **Western Arc Welding**, Los Angeles. Western Arc will continue to operate independently as a subsidiary company . . .

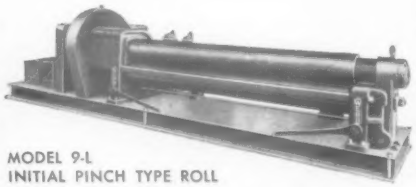
Acetylene Products Co., Indianapolis, Ind., in cooperation with its manufacturers, conducted an open house and welderama during Sept. 28 to 30, from 2 to 9 p.m. . . . **Aluminum Co. of America**, Pittsburgh, has abandoned the term "pig" as a designation for primary aluminum products. In the future, they will be described by the firm as "ingots" . . .

WEBB PLATE FABRICATING MACHINERY

PLATE BENDING ROLLS

The Webb Corporation offers a complete line of Plate Bending Rolls for the rolling of the thinnest plate up to plate 2½" thick. Offered in a variety of lengths and thicknesses. Constructed for the modern fabricating shop.

Two types available: the Initial Pinch Type and Pyramid Type machines. All latest advantages of todays modern machine tools are incorporated, utilizing anti-friction bearings, totally enclosed gear drives. Special forming rolls for culvert pipe, stock tanks and other special shapes available.



MODEL 9-L
INITIAL PINCH TYPE ROLL

MODEL PBR-500 PYRAMID TYPE ROLL
10' x 2⅝" Capacity

SLIP ROLLS
UP TO 8 GAUGE PLATE

SLIP ROLLS

A complete line of small Sheet Metal forming Rolls are also available. All power-driven with shaft sizes 3" to 5" for the handling of the thinnest gauge material, up to 8 gauge material. Special rolls for the forming of polished sheets, aluminum and stainless steels can be furnished. Complete catalogues on any size machine furnished upon request.

Let Speed PAY—The WEBB Way!

Also manufacturers of INDUSTRIAL WEIGHING EQUIPMENT

Since 1881 THE WEBB® CORP.
WEBB CITY, MO., U. S. A.

NEW FROM TEC

THE NEW TEC AIR-COOLED TORCH!

MODERN DESIGN BY TEC

Tec research and endless testing have provided an easy handling and smooth, effortless operating, the most up-to-date air-cooled torch on the market.

USER MINDED ECONOMY

Tec Visuweld transparent Gas nozzles (both standard and off-set) and Tec chucks are interchangeable with the new air-cooled torch . . . no need to stock or store new parts.

GAS SAVING ECONOMY, TOO

Preliminary testing has already indicated that considerably less gas with greater coverage is afforded with the new air-cooled.

RUGGED CONSTRUCTION

Durable and long lasting due to one piece construction of phenolic plastic reinforced with macerated fiber glass.

Contact your local distributor or write:

SPECIFICATIONS

Engineered to most efficient performance.

MODEL 3110 (Pencil Grip)
Rated Capacity:
Continuous duty cycle: 80 Amp.

Overall length: 9¾"
Handle diameter: 1 inch.
Maximum electrode length: 6 inches.
Electrode diameter: .020, .040, .0625.
Cable lengths: 12½ or 25 feet.

MODEL 3330 (Pencil Grip)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.
Electrode diameter: .020, .040, .062, .093.

MODEL 3220 (Angle)
Same as 3110 except:
Overall length: 8 inches.
Handle diameter: 1 inch.
Electrode length: 3 inches.

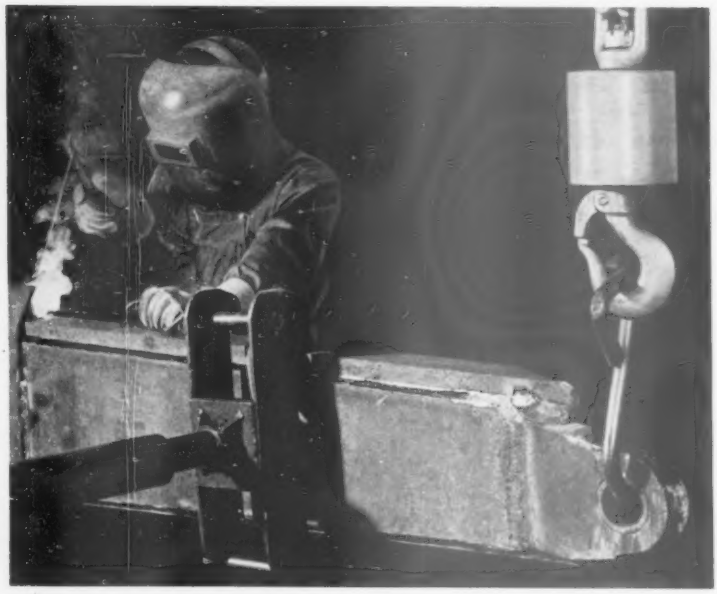
MODEL 3440 (Angle)
As above except:
Rated Capacity:
Continuous duty cycle: 130 Amp.
Reduced duty cycle: 150 Amp.

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. MANUFACTURERS OF VISUWELD EQUIPMENT

For more facts Circle No. 205 on Reader Service Card

New products

. . . use card on page 117



Insulated link

Low-voltage insulated link was designed to insulate hoisting mechanism from weldment. When weldment is not properly grounded, current flows back through chain into the hoist. Links are manufactured in sizes ⅜-to 5-ton, 1 kv. Steel inserts separated with laminated insulating core are wound with glass fiber roving and bonded together with epoxy resin. *E. D. Bullard Co.*

Circle No. 9

Safety glasses

Manufacturer claims line of plastic frame safety glasses will fit 9 out of 10 faces without adjustment. "Sell-Fit" glasses are built around a broad and continuous bearing surface for the bridge area that assures maximum comfort, even weight distribution and secure support. Lens frames are molded in the currently popular S-7 square shape; colors are flesh and charcoal. Model 720CS offers new clear transparent flat-fold side shields which are built into temples. All models available in hardened clear, green absorptive and didymium lenses. *Sellstrom Mfg. Co.*

Circle No. 10

Fatigue test machine

Labeled model LAZ-1, universal testing machine for combination fatigue testing is stressed to withstand the most punishing testing programs, according to manufacturer. Machine measures 29½-in. by 27⅛-in. by 67-in. high; control rack is 22-in. by 17-in. by 70-in. high. Unit provides for static or dynamic testing on a selective basis creep or fatigue work may be accomplished with either of the two sections. Other features include detachable unitized components for direct test on structural members too large for the frame; simple dynamic unit designed to function independently or with the static unit; wide range of accessories including furnace and grips for specimens of various sizes, flats and rounds. *The Budd Co.*

Circle No. 11

Hardfacing alloy

Weld metal from Wear-Arc CoCr-A electrodes and Wear-Flame CoCr-A welding rods have excellent resistance to thermal shock, impact and corrosion, according to manufacturer. It retains its hardness at temperatures up to 1,200 F and has scaling resistance at temperatures as high as 1,900 F. Coated electrodes are available in 1/8, 5/32, 3/16, and 1/4-in. sizes; rods, in the same plus a 5/16-in. size. All diameters are supplied in 14-in. lengths packaged in 10-lb hermetically sealed containers. *Alloy Rods Co.*

Circle No. 12

Extra-large gloves

Newly announced additions to firm's line include extra-large, jumbo size spot and heavy weldor gloves. Gloves can be obtained with or without linings, and are made of same quality materials as regular size models. *Riegel Textile Sales.*

Circle No. 13

X-ray films

Firm's type 506 fine grain and type 510 extra fine grain X-ray films are being reproduced on "Cronar" polyester film base — a tough, fast-drying material that has exceptional resistance to stretching or shrinking under changing temperatures and humidity. Because polyester base absorbs almost no moisture, film dries quickly, thus speeding up processing time. Film is easier to handle because it lies flat and remains taut on the hanger, manufacturer reports. Types 506 and 510 film packaged in firm's Day Pack rolls are also available on polyester base. These rolls, 70 mm wide and 200 ft long, are designed for use in making inspections of circular surfaces. *E. I. Du Pont de Nemours & Co.*

Circle No. 14

Non-corroding alloy

"Cunisil-837," an alloy of 97.50% copper, 1.90% nickel and 0.60% silicon, is corrosion resistant, has high tensile strength, high yield strength, and excellent cold-forming characteristics before hardening heat treatment. Compared with free-cutting brass rod at 100, its machinability rating is approximately 40. It has a density of about 0.322 lb per cu in.; coefficient of expansion per degree Farenheit from 68 F to 572 F is about 0.0000098. Made in round rod, with or without final precipitation-hardening heat treatment as follows: straight lengths including 3/16-in. diameter to 1-in. diameter, and coils including 3/16-in. diameter to 5/8-in. diameter. *The Anaconda Co.*

Circle No. 15

Silicon rectifier

Double diffused, hermetically sealed silicon power rectifier, Style 40, is rated at 60 amp average at 68 F ambient on 7-in. by 7-in. by ⅜-in. copper heat sink. Peak inverse voltages range from 100 to 400 in 100-volt steps. Typical forward dynamic resistance of 0.0015 ohms is achieved by diffused junction techniques. Temperature range is −102 F to +347 F. *Syntron Co.*

Circle No. 16

Projection welder

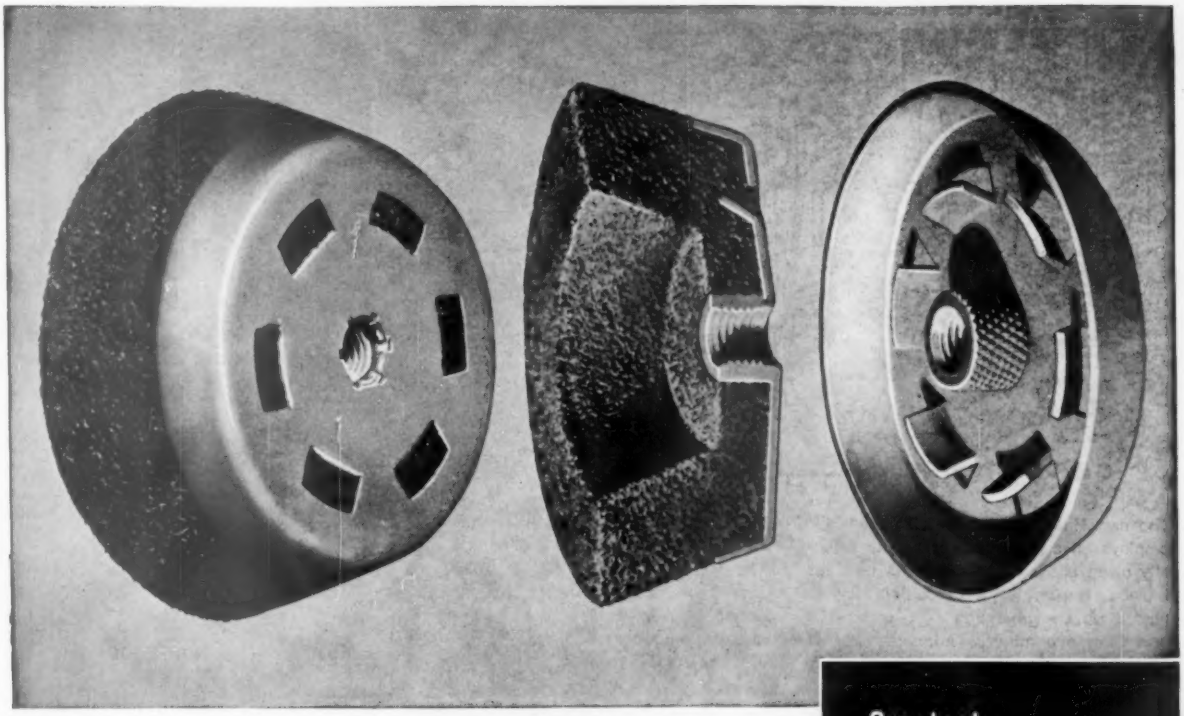
Model 2400 projection welder has the ability to encapsulate semi-conductor and transistor components by resistance welding over a wide range of sizes on one piece of equipment. Welding head features two-column construction to eliminate deflection plus a low inertia force system. Welding force may be varied from a minimum of 300 lb up to maximum of 2,400 lb and energized by 80 psi air. Twin transformers, of 75 kva rating at 50% duty cycle, provide a maximum short circuit current of 64,400 amp and have 16 pts of heat regulation. *Thomson Electric Welder Co.*

Circle No. 17

Testing gages

Cylinder testing gages are available in two types—400-lb for all acetylene cylinders, and 3,000-lb for hydrogen, argon and oxygen. According to manufacturer, gages may be used with nine different fittings. A testing block without gage or nut and nipple is also available. *Western Enterprises, Inc.*

Circle No. 18



MANHATTAN

THE ORIGINAL *SAFETY BACK* FLARED CUP

The first wheel to offer the exclusive features of the Safety Back Flared Cup! This totally new concept of design *and* construction puts portable wheel *safety* where it counts the most — in *original* strength and breakage resistance! With Safety Back, steel covers the entire back of the flared cup . . . extends down the side to assure a degree of reinforcement never before available with anchor bushings, safety rings, special hub mountings or ordinary revolving cup guards.

You can't get a safer wheel to use . . . and you can't find a better performing wheel to use on your portable grinders. Every Manhattan Safety Back Flared Cup is custom-bonded with the right abrasive for *faster* removal of *more* metal on your particular job — at no extra cost!

For faster cutting, longer lasting, *safer* abrasive wheel performance — "More Use per Dollar" — be certain you get the original Manhattan Safety Back Flared Cup. Let your Manhattan abrasive wheel engineer show you the exclusive advantages of this and other Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.

- Greatest Initial Strength
- Easy Mounting — Easy Operation
- Highest Safety Factor
- Requires No Adjustment
- One Piece Assembly
- Improved Mounting Base

"MORE USE PER DOLLAR"

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

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RM 1060

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

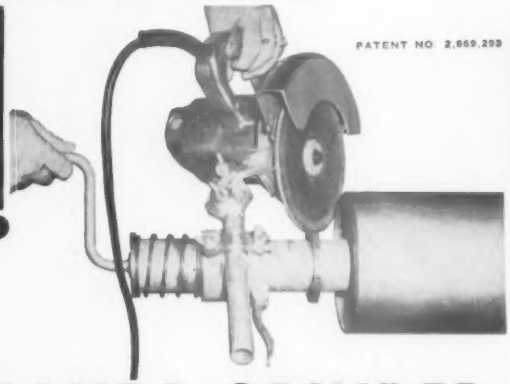
RAYBESTOS-MANHATTAN, INC.

For more facts Circle No. 206 on Reader Service Card

For more facts Circle No. 207 on Reader Service Card

NEW!

H&M



PATENT NO. 2,869,293

"BEVEL-LAND" GRINDER

automatically cleans and lands pipe bevels

The new H & M "BEVEL-LAND" GRINDER employs an electric grinder to automatically clean and smooth pipe cuts and put the land on bevels. The machine may be placed on the pipe and in operation in less than one minute. A simple adjustment in angle of the grinding wheel is all that is required to change the machine from the cleaning to the land position. The H & M "BEVEL-LAND" GRINDER assures more postive alignment of pipe and better quality welds. The machine is available in two models: one for 6" to 14" and one for 14" to 36" pipe.

WRITE FOR YOUR COPY OF A CATALOG SHEET WHICH DESCRIBES ALL THE FEATURES OF THE NEW H & M "BEVEL-LAND" GRINDER.

H&M

TM Reg

PIPE BEVELING MACHINE COMPANY

311 E. Third St. DI 3-0241

TULSA, OKLAHOMA

ACRO WELDER MFG. CO.

MILWAUKEE

WELDING ENGINEERS

MACHINERY BUILDERS

ESTABLISHED 1936

ACRO® general purpose spot-projection-butt-seam resistance welding machines.

ACRO-ARC® special purpose production welding machinery employing automatic arc welding processes.

ACROMATIC® special purpose production welding machinery employing resistance welding processes.

ACRO-MAGNETIC® magnetic force spot, projection, and percussion welding machines.

Magnetic-particle system

Recordaflux is used to detect defective welds, cracks, inclusions and other flaws in such materials as are inspected by magnetic-particle systems. When specially developed solutions containing magnetic particles are sprayed or poured on surface of a part, particles are free to migrate in solution. When solution sets in a strippable plastic film, particles are frozen in place. They show the size and shape of a spot, or other type weld and their defects. Copies of the patterns are readily obtained by passing the films through reproduction equipment. *The Budd Co.*

Circle No. 19

Test chambers

With the addition of optional equipment, multipurpose self-contained environmental test chambers can be adapted to "dry box" welding. Chamber sizes often lend themselves to the installation of firm's orbiting electron beam gun for doing closed loop welding or butt welding long tube sections which, because of configuration, cannot readily be moved but are held stationary while the gun is rotated. Polished stainless steel construction assures low internal leakage rate and reduces cleaning time. *High Vacuum Equipment Corp.*

Circle No. 20

Flux-coated alloy

Flux-coated silver-brazing-type alloy cuts brazing time by two-thirds through elimination of separate flux, according to manufacturer. EutecSil 1020FC alloy is available in rods of 1/16- and 3/32-in. diameter, and is suitable for ferrous and non-ferrous metals and all types of joints including tee, butt, fillet, and lap or sleeve. Features include low application temperature and high fluidity, strength, and high electrical conductivity. Deposits are cadmium-free and thus product may be used safely on food vessels and processing equipment. *Eutectic Welding Alloys Corp.*

Circle No. 21

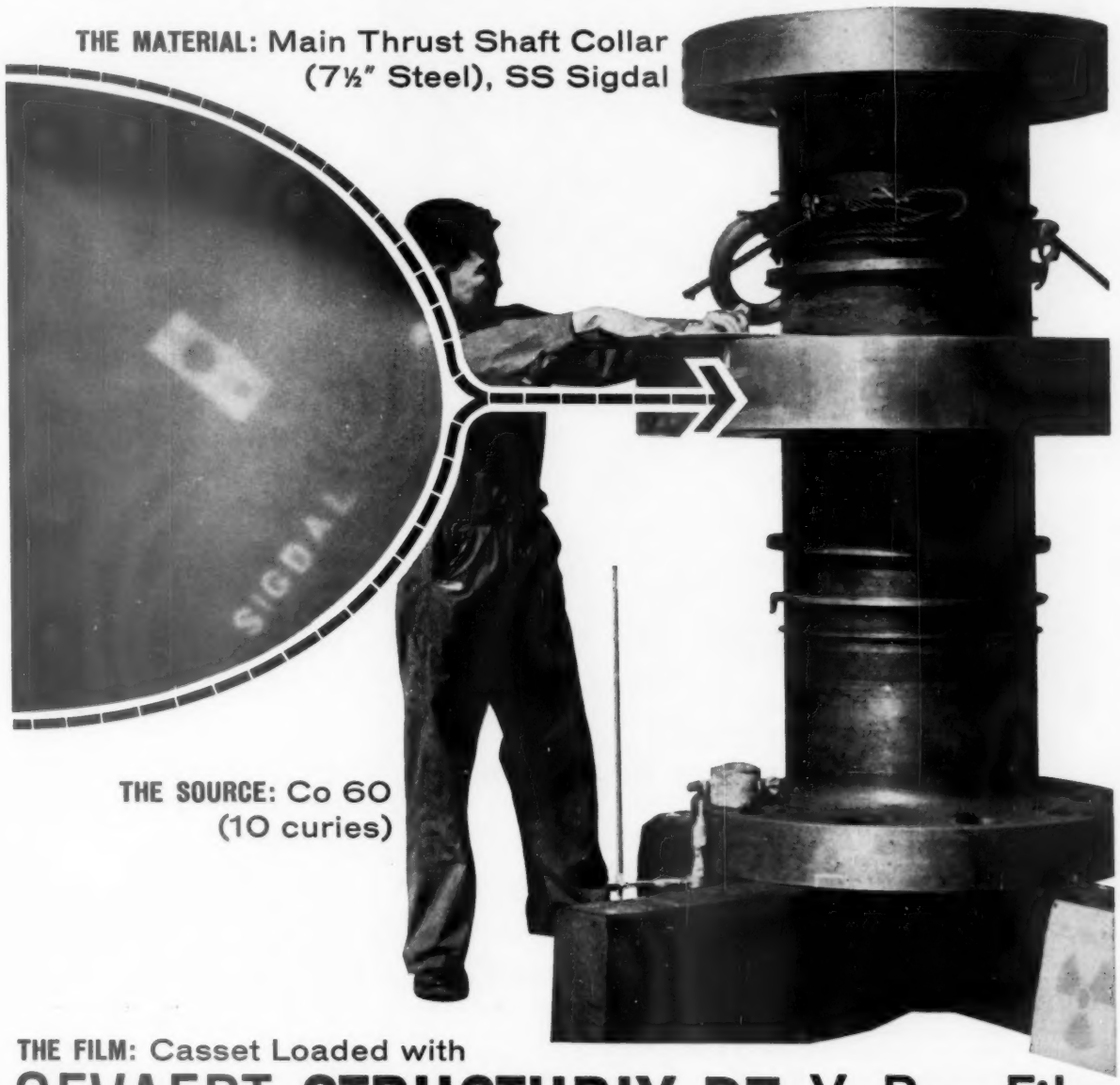
Gas heaters

Additions to Insto-Hot LP-gas heater line include the following: No. 1412 salamander has larger and heavier base than previous model, measuring 14-in. in diameter; an auxiliary blower unit has been made available for the 1700 series; a cylinder cart for 100-lb cylinders is available primarily for use with infrared heaters. Other additions include No. 65 barrel heating torch, No. 6 large capacity hand torch, and two portable furnaces for melting lead and compounds. *Insto-Gas Corp.*

Circle No. 22

THE TEST: Radiographic Examination, Todd Shipyards Corp. (Bklyn. Div.)

THE MATERIAL: Main Thrust Shaft Collar (7½" Steel), SS Sigdal



THE SOURCE: Co 60 (10 curies)

THE FILM: Casset Loaded with

GEVAERT STRUCTURIX D7 X-Ray Film

In a recent gamma ray examination by N.Y. Testing Laboratories, Inc., (in accordance with MIL-STD-271A requirements) the film chosen for optimum penetration was Gevaert's STRUCTURIX!

Whenever radiographic tests of product structural quality are conducted in a laboratory or field, industry relies on Gevaert STRUCTURIX films for the searching "look". These films probe ever deeper in their search for hidden flaws . . . and offer greater readability, as well as a sturdy base that facilitates handling ease.

Gevaert STRUCTURIX Films are available in five types, each designed to excel in its specific job application. Your inquiry for complete details and professional samples will be answered by the nearest Gevaert branch.

FREE! *Write for a Handy Exposure Calculator for either Co 60 or Ir 192 Radiography of Steel. Specify the one desired!*

GEVAERT

THE GEVAERT COMPANY OF AMERICA, INC., *321 West 54th Street, New York 19, N. Y.*
District Offices: Lincolnwood (Chicago), Ill. • Los Angeles • Dallas • Denver • San Francisco

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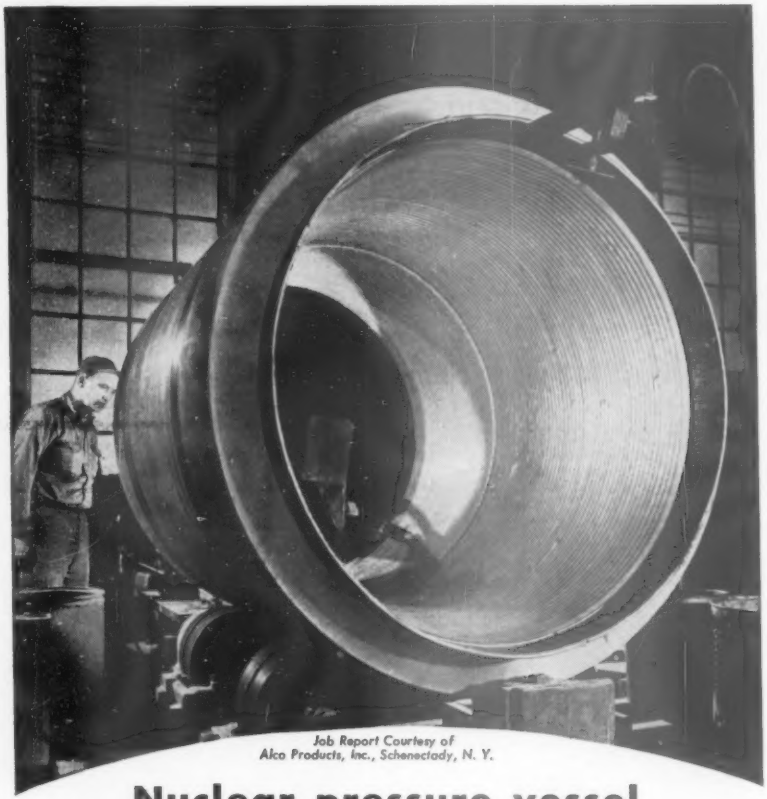


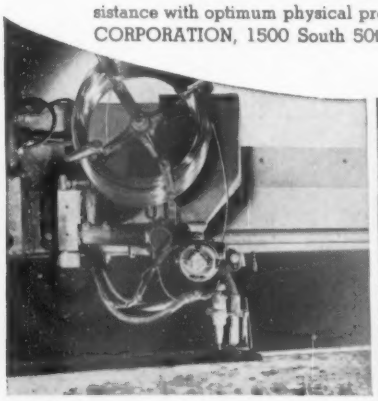
Job Report Courtesy of
Alco Products, Inc., Schenectady, N. Y.

Nuclear pressure vessel stainless clad at low cost

USE ARCOS

STAINLESS WIRE and BONDED FLUX

This "barrel" is one of several that comprise a nuclear pressurizer to operate under highly corrosive conditions. To reduce costs, Alco Products forged the shell of ASME A-336, 2—4 inch thick manganese molybdenum steel and clad the inside with stainless. The illustration shows the second pass overlay which was made by submerged arc using Arcos Chromenar K-LC (Type 308) bare wire and Arcosite S4 flux. Lower cost, and high corrosion resistance with optimum physical properties were obtained. ARCOS CORPORATION, 1500 South 50th St., Philadelphia 43, Pa.



Bare Wire

Arcosite Flux

Portable blast cleaner

Model BC-1 portable blast cleaner features gun providing trigger-operated control. Weight of unit is 25 lb. Twenty inches high and with a capacity of 50 lb sand, unit comes complete with hood, blasting gun, adjustable feed elbow, screen and 10-ft blast hose and connection. *Bren Weld Corp.*

Circle No. 23

Iron powder electrode

Zip-2, result of the addition of iron powder to the standard E6012 electrode, is designed for all types of structural and plate welding. Manufacturer claims electrode is ideal for wrought iron, low and medium carbon steels, low alloy steels, copper bearing steel, and low or medium carbon cast steel. Faster metal wash and slag removal is also claimed, leading to faster welding speeds on lap and fillet welds. *Westinghouse Electric Corp.*

Circle No. 24

Safety spectacles

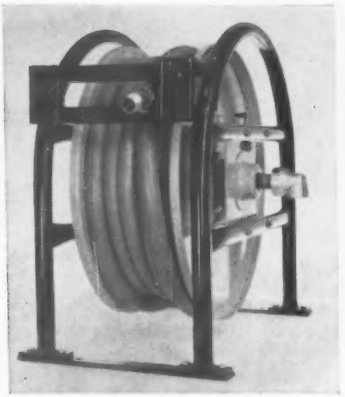
No. 471 "Adapta-Spec" features clear safety lens, spatula temples and partial side shield. Made of butyrate plastic, frame and bridge fit the facial contour of more than 95% of wearers, manufacturer states. No. 479 has green safety lens, cable temples and perforated side shields. *American Industrial Safety Equipment Co.*

Circle No. 25

Rubber grinding wheel

Solid rubber grinding wheel fits directly on spindle. Abrasive belts in desired grits can be slipped over wheel to give it an abrasive perimeter. Under operation, belts are held positively by centrifugal expansion of the rubber wheel, without any mechanical locking devices or back-stand arrangements. Abrasive bands are self-cleaning and are especially suitable for flat work and weld grinding. Firm's grinders available in speeds of 4,500 or 6,000 rpm in 6-in. capacity. *Thor Power Tool Co.*

Circle No. 26



Automatic hose reel

Model A-4 heavy duty automatic reel for industrial hose has capacity for 50 ft of ¾-in. ID, 2-braid, single hose. Connections furnished are: swivel, ¾-in. npt, female thread; shaft, 1-in. npt, female thread. Recommended working pressure with standard 2-braid hose is 250 psi. Reel drum is ball-bearing-mounted and operated by a clock type motor spring. Ratchet type locking mechanism locks during 170 deg of each turn of the drum; it is easily reversed by pulling on the hose. Reel can be mounted in any position and hose roller assembly can be easily adjusted to give a straight-out pull on hose. *United Specialties, Inc.*

Circle No. 27

Clamp system

Only six standard parts can be assembled into 32 different styles of clamp to meet a wide range of requirements. Clamps are easily assembled by means of spline-fit torque pins, of uniform length, and snap rings at all pivot points. The six components are made of forged or cold rolled steel, capable of withstanding the roughest production use. Arm, link, and base mounting holes are standard and interchangeable. *Industrial Specialties Inc.*

Circle No. 28

High current rectifier

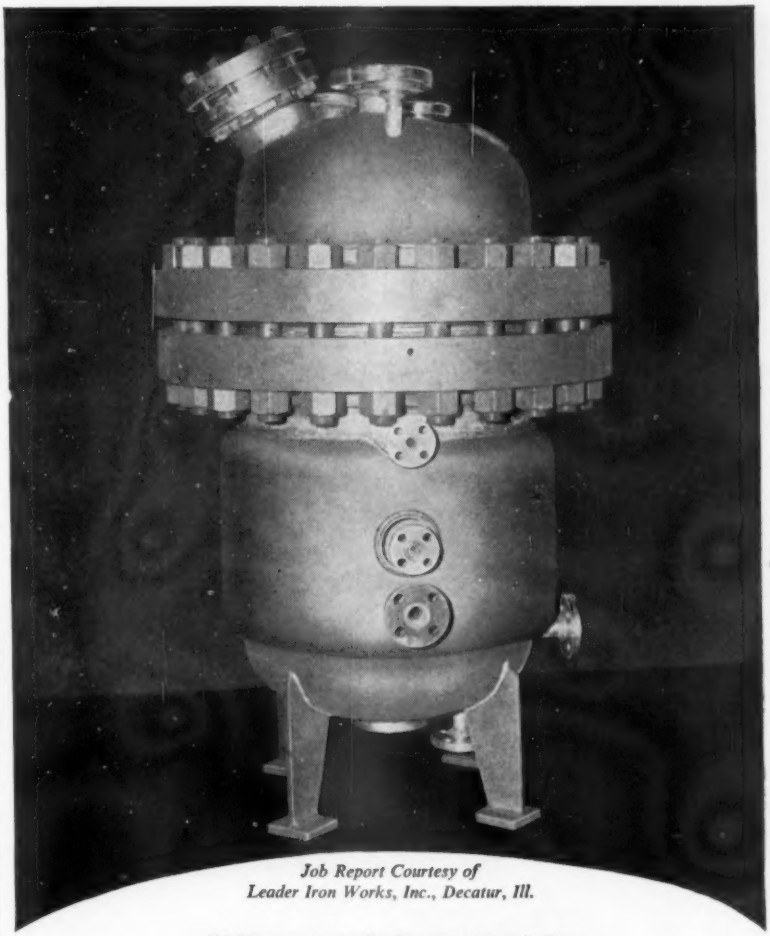
New 10-amp, 1,000 peak inverse voltage rectifier was especially designed for those control applications requiring a high current half-wave rectifier. Model NL-664L incorporates firm's designed lug base as a standard feature. It is also available with bracket base and flying leads for panel mounting. Other ratings of unit are: filament volts — 2.5; filament current — 25 amp; peak anode current — 120 amp and condensed mercury temperature limits of —40 F to 212 F. *National Electronics, Inc.*

Circle No. 29

A36 carbon steel

Average savings of 4 to 6% in the weight of steel structures are promised by new higher yield-point structural carbon steel, states producer. New steel conforms to specifications A36-60T for rolled structural steel recently approved by ASTM. Compared to A7 and A373 steels, the new A36 has a minimum yield point of 36,000 psi. Matched against A7 on an equal-strength basis, A36 will withstand about 10% greater load in tension before it reaches its yield point. *United States Steel Corp.*

Circle No. 30



Job Report Courtesy of
Leader Iron Works, Inc., Decatur, Ill.

When stainless welds must also resist heat and pressure

This sturdy autoclave made of Type 316 stainless steel must operate under pressures up to 1000 psi at 600°F. Code specifications called for X-ray quality weld. To meet all these conditions for successful and long performance Arcos Chromend KMo (Type 316) electrodes were used for joint fabrication. When you use Arcos Stainless Electrodes you can always count on their providing multiple benefits.

WELD WITH ARCOS

STAINLESS ELECTRODES

for quality weld metal

ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Pa.

NOW ✓...

CHECK with your LINDE DISTRIBUTOR for *Oxweld*

APPARATUS, too

With the *Oxweld* line of quality oxy-acetylene apparatus added to this list, he's your fastest, most complete source of dependable, top-name welding and cutting equipment:

- ☐ OXWELD apparatus and supplies
- ☐ PUROX apparatus
- ☐ HELIARC apparatus
- ☐ SIGMA apparatus
- ☐ UNIONMELT apparatus
- ☐ PREST-O-LITE small tanks, appliances, and acetylene
- ☐ LINDE industrial gases

Your LINDE distributor is a welding specialist, superbly equipped and stocked for immediate delivery of a full line of quality products. To his already extensive list, the *Oxweld* line adds the most efficient high quality gas welding materials available today. There's a LINDE distributor near you. Call him for *all* your welding needs. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto.

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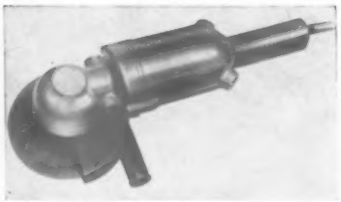
Linde UNION CARBIDE



Right angle grinder

Heavy-duty angle grinder saves much time due to its 8,000 rpm speed and low 14½-lb weight, says manufacturer. Gears are hardened, ground, and lapped. Heavy-duty 16-ft, 3-conductor cord with grounding plug, wheel guard, backing flange and clamping nut included. *Technica Corp.*

Circle No. 31

Silver brazing rods

While paste fluxes may be used with Silvaloy 15 and Silvaloy 5 brazing rods, their self-fluxing ability makes them particularly useful in silver brazing of joints where complete flux removal is difficult but important. Nominal composition of Silvaloy 15 is 15% silver, 80% copper, and 5% phosphorus. Its optimum brazing temperature is slightly above 1,280 F, at which point melting of the alloy is virtually complete. Intended primarily for use on copper and copper alloys, Silvaloy 15 may also be used on silver, tungsten and molybdenum, but should not be used on ferrous alloys or nickel. Possessing generally similar properties, Silvaloy 5 consists nominally of 5% silver, 88.75% copper, and 6.25% phosphorus. *Engelhard Industries Inc.*

Circle No. 32

Winter liners

Full line of winter liners includes neoprene-coated liners without metal parts for use with electrical hats and

caps, knitted liners for universal use and disposable liners for perspiration absorption and for use as a visitors sanitary liner. Chin straps with adjustable snaps enable snug fit in all available sizes. For extremely frigid climates, liner models are made with an extra urethane insert lining. *Fibre-Metal Products Co.*

Circle No. 33

Circle No. 212 on Reader Service Card

QUIK-HEAT

up to 2200° F.

CLEMENTS

Cadillac

MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F, in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

Operates on natural, manufactured, or LP-gas.

CLEMENTS MFG. CO.
6645 S. Narragansett Ave., Chicago 38, Ill.
SINCE 1910

INDUSTRIAL PRODUCTS DIVISION

No Other Product Can Do a Galvanizing Job Like

Galvalloy

Does - *HERE'S PROOF*

Heat welded seam on galvanized sheet to 600° with Torch

Rub GALVALLOY against heated surface as shown — now spread with wire brush for a bright finish.

GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

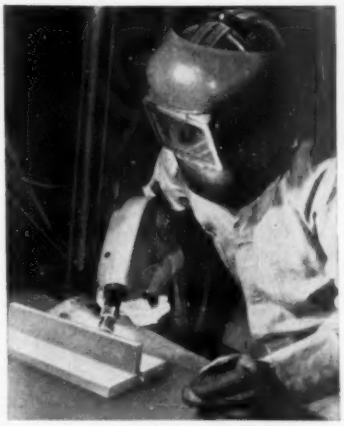
Send today for Testing Sample and you'll learn Why GALVALLOY has no equal for ANY Galvanizing Job.

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

Circle No. 213 on Reader Service Card

Mig gun and controls

Manual Mig gun and controls are designed for use in light to heavy fabrication where numerous short welds, off-the-ground welding, or emergency repairs are necessary. Gun carries its own compact reel of wire, wire feeding drive rolls, and complete-range wire



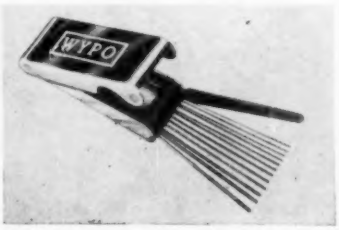
speed control in the gun itself. Operator can weld as far as 50 ft away from the control panel. Control panel, in turn, can be placed 150 ft distant from power source. Control, weighing less than 20 lb, is housed in a small NEMA cabinet with a carrying handle on top and cable and hose fitting on bottom. Gun, called MIGet, is rated at 200 amp d-c reverse polarity at 100% duty cycle using argon or helium, will handle 0.030-in., 3/64-in. and 1/16-in.-diameter aluminum wire and 0.030-in., 0.035-in. and 0.045-in. hard wire. *Air Reduction Sales Co.*

Circle No. 34

Portable nibbler

Employing fast, punch-and-die cutting action, lightweight, portable nibbler will cut steel, stainless, copper, brass, aluminum, all without distortion to the surface, claims manufacturer. Nibbled edges are smooth and need no deburring. Operator safety is assured because pieces of metal are forced down and away from operator, preventing possible eye or face injury. *Fenway Machine Co., Inc.*

Circle No. 35



Polishing file

Wypo polishing file is now included with tip cleaners contained in polished aluminum case, formed to serve as a handle for the file while in use. Other features are rounded outer edges of cleaning ridges allowing the cleaning and polishing of tip orifices without scratching or cutting, and smooth pilot, designed to guide tip cleaner into tip without enlarging or damaging tip port. *Maitlen and Benson, Inc.*

Circle No. 36

It's GOOD BUSINESS to DO BUSINESS with your LINDE DISTRIBUTOR because...

Your LINDE Distributor carries a *complete* line of all the welding and cutting equipment and supplies you need in your business. These are products recognized for their outstanding high quality and efficiency. In most instances, he can fill your order *from stock*, to save you time and effort.

Your LINDE Distributor anticipates your requirements... *knows your business*... is ready and able to fulfill your needs promptly. He has the experience of a welding specialist... which means good *service, quickly*.

Your LINDE Distributor is a local, independent business man—just as you are. He appreciates your business and wants repeat orders.

Your LINDE Distributor has the full resources of LINDE COMPANY behind him. For 50 years, LINDE has been a leading producer of top-quality welding and cutting equipment and materials—famous for know-how and service.

Your LINDE Distributor is as convenient to you as your telephone—call him for all your welding and cutting requirements. If you have not yet made his acquaintance, look in the Yellow Pages under "Welding Supplies." Or write Dept. 330, LINDE COMPANY, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N.Y.

Linde UNION CARBIDE

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Circle No. 211 on Reader Service Card

For more facts Circle No. 214 on Reader Service Card

BECKER
Keen-Cut
Electrodes

for use in CARBON ARC-AIR JET GOUGING

KEEN-CUTS—for the best characteristics of carbon and graphite in a carbon arc cutting electrode. Higher current capacity . . . longer life . . . shorter cutting time . . . greater material removal . . . smooth surface gouge . . . controllable accuracy . . . hot stable cutting arc . . . elimination of smoke and gases.

And they're low in cost. Try BECKER KEEN-CUT ELECTRODES—black or copper coated, standard diameters, 12" lengths in 150 to 1400 amp. range—for the most efficient, labor-saving electrode in carbon arc/compressed air cutting.

A COMPLETE LINE OF CARBON AND GRAPHITE WELDING SUPPLIES—carbon and graphite electrodes, carbon rods and plates, welding paste, graphite cores and chills, graphite powder and particles of any mesh.

Write for Catalog

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DOC TUFFY
TO THE RESCUE
WELDING ENGINEER
DOC! I'VE GOT A MILLION JOBS TO DO! JUST CAN'T GET TO THOSE RESISTANCE WELDING SPECIALS!
YOUR PROBLEM HAS A SIMPLE, PRACTICAL SOLUTION... CALL A TUFFALOY SPECIALIST!
Why burden your staff with the puzzles of resistance welding electrode design? Free up your engineers for the bigger, more pressing jobs.
Call in the Tuffaloy expert. He'll give you practical, money-saving electrode designs. Write or call your local Airco or Tuffaloy office. Today.
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Air Reduction Pacific Company • Air Reduction Canada Limited

For more facts Circle No. 233 on Reader Service Card

Grinding wheel

Called the "Koolie Hat" because of its shape, grinding wheel permits holding the wheel at a lower angle to the work, resulting in better control. Manufacturer claims new shape reduces operator fatigue by eliminating jitter and bounce thus lowering accidents. By providing narrow, radial contact between wheel and work, wheel speeds remain high to insure fast removal of welding beads without excessive heat build-up. Available in 7- and 9-in. diameters, wheels are 1/4-in. thick. *Bay State Abrasive Products Co.*

Circle No. 37

Power supply

Model 150 power supply for firm's arc spot weld gun is provided with 5-heat stage receptacles and male plugs to insure fast, positive connection. Used with model H arc spot gun, supply will weld 14-gage or lighter to any thickness (minimum 2 pieces, 26 gage). Unit weighs 41 lb, operates on 115 volts. *Bren Weld Corp.*

Circle No. 38

Silicon rectifier

Silicon rectifiers are capable of withstanding urge currents of up to 20 times their nominal current rating (1000 amp peak at rated full load). Each rectifier is "quad-sealed" by a four-barrier sealant and class II varnish process, completely enclosing the assembly in a rugged case resistant to moisture and contaminants. Two new series provide d-c output ratings from 45 to 150 amp, peak reverse voltage ratings from 50 to 600 v over an operating temperature range from -20 C to +130 C. *International Rectifier Corp.*

Circle No. 39

Welding-cutting outfits

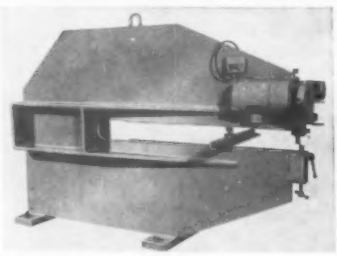
Four new welding and cutting outfits are designed for the job shop, home or farm use. Model 1225-C is a heavy-duty industrial outfit designed for easy portability. Lightweight model 1900-C is built for precision auto-body and hobby-craft work and comes complete with No. 19-B torch with extra tips. Model 7500 is a propane cutting outfit designed for scrapyard work. It includes a No. 75 torch and tips, two No. 25 regulators, and 25 ft of ¼-in. twin hose. The 7800, also intended for scrapyard work, is an acetylene cutting outfit. *Harris Calorific Co.*

Circle No. 40

Safety caps

High-pressure, molded fiberglass hats and caps combine high strength with lightweight comfort, states manufacturer. Models feature rugged nylon suspension of easy snap-in design with minimum number of pressure points. Suspension automatically centers. Headbands adjust from 6⅜ to 7⅝ sizes. Winter liners available. *Welsh Mfg. Co.*

Circle No. 41



Shearing machines

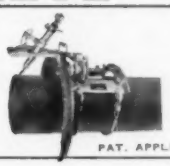
Line of shearing and forming machines offers an economical method of straight, circular and irregular shearing, plus slotting, folding, beading, joggling, edge bending, and louver cutting, says manufacturer. Capacities of the new line range from 14 gage up to 7/32-in. in mild steel. *American Pullmax Co., Inc.*

Circle No. 42

For more facts Circle No. 217 on Reader Service Card

H&M PRODUCTS FOR PROFITABLE PIPE CUTTING AND BEVELING

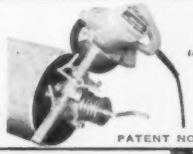
STD. MACHINES



PAT. APPLIED FOR

FAST, accurate cutting and beveling of all sizes of pipe from 1½" - 36". Simple operation . . . operator can master machine in a matter of minutes.

"BEVEL-LAND" GRINDER



PATENT NO. 2,869,293

No more time consuming handwork. "BEVEL-LAND" smooths pipe cuts and accurately places the lands on bevels in a matter of seconds.

OUT-OF-ROUND

Insures even, accurate cuts of irregular pipe. Roller rides pipe surface . . . makes cutting easy, simple. Fits all H&M Machines.

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SHAPE CUTTER

Accurately cuts saddles, tees, els and other irregular shapes. Lightweight, extremely portable . . . fits all H&M Machines.

PATENT APPLIED FOR

WRITE FOR CATALOG SHEETS AND PRICE LISTS ON THE COMPLETE H&M LINE.

H&M TM Reg

PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TULSA, OKLAHOMA

COOPER *PORTABLE* WELDER

MODEL "CP7"

Cooper hi-thermal transfer water cooled transformer producing 12,000 amps.

2" stroke double acting tandem cylinder, solenoid quick exhaust valve.

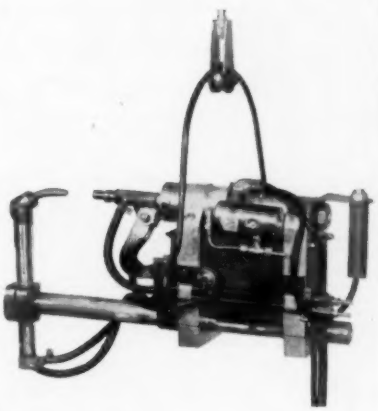
Universal swivel bail suspension, universal electrode holders.

Several means of suspension available.

Weight — 50 pounds.

Can be used with any N2 control or with special Cooper sequence controls.

Capacity: Lightest through 14 gauge, two pieces ⅛" on low duty cycle.



Price Sheet available on request. Write:

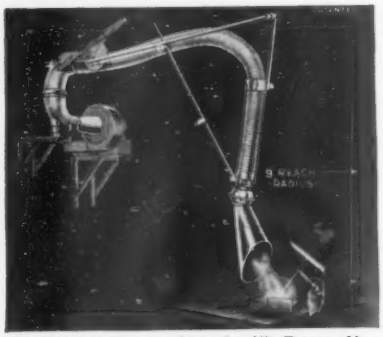
COOPER WELDERS, INC.

MORTON GROVE, ILLINOIS

For more facts Circle No. 218 on Reader Service Card

Circle No. 216 on Reader Service Card

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.

3880 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.

Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

In 1936, MORT CLARK, then Vice-President of the World's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding foundation — and

MORT CLARK'S **GALV-WELD** ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959 —23 YEARS LATER!

TIME PROVEN - MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 18 national magazines.

Mail Coupon Today

GALV-WELD PRODUCTS

Dept. WE — Box 1303 — Bradenton, Fla.

Send Information User ☐ Distributor ☐ Dealer ☐ Free Sample ☐

Name ..... Address .....

City ..... State .....

Circle No. 215 on Reader Service Card

VIPs in review . . .

Philips Electronic Instruments, Mount Vernon, N. Y., has made major changes in assignment of key personnel. *C. Jack Woods* and *John S. Buhler* have taken over operation of a new market development and research operation. *Stanly Oren* will assist as sales engineer for this group. *Philip I. Wolf* has been appointed sales manager, *John W. Field* sales manager, and *John Hoskins* technical-commercial assistant manager.

Parker

Jones

At Sperry Products Co., Danbury, Conn., *Philip J. Parker* has been appointed as general sales manager. He has an extensive sales background in the non-destructive testing field.

James F. Jones has been named group executive in charge of the A. O. Smith Corp., Milwaukee, industrial products group, which includes welding products. Prior to his appointment, Jones was general manager of the firm's automotive and railway products group. He succeeds *John Randall*, who has resigned to accept another position.

Vickers, Inc., Detroit has named *Charles K. Apel* industrial controls sales manager for the Electric Products Div., St. Louis. He previously served as a regional sales engineer, field engineer, and branch manager. In another appointment, *Dr. W. Wai Chao*, who joined the firm as chief of research in 1959, has been made director of research and development.

Lukens Steel Co., Coatesville, Pa., has promoted *George L. Stroman, Jr.*, to superintendent of the flanging department; *Charles H. Brown* to manager of the research department; and *George L. Germain* to supervisor of development and training. Stroman and Brown have been with Lukens more than ten years; Germain came to the firm from Chrysler Corp., Detroit.

John W. Allen has been selected manager, engineering and nondestructive testing, of the Instruments Div., The Budd Co., Philadelphia. Allen comes to Budd from the Atomic Energy Commission's Oak Ridge National Laboratory in Tennessee.

W. Blake Tripp was recently appointed plant manager at United Welders, Inc., Bay City, Mich. In his new position, he will be responsible for engineering and manufacturing of the company's special-purpose and assembly machines.

Thomson Electric Welder Co., Lynn, Mass., has promoted three men to executive sales positions. They are: *C. Dana Moore*, who advances to sales manager; *John G. Grant, Jr.*, who moves up to assistant sales manager; and *George R. Grant*, who becomes factory sales manager.

Ron Bever and *Ron Arkils* will head a new west coast office of Progressive Welder and Machine Co., Pontiac, Mich. The new office is at 5909 Melrose Ave., Los Angeles. Progressive's representative for Ohio, western Pennsylvania, and western New York is *Don Campion*.

Chalberg

Langhenry

H. W. A. Chalberg has joined National Electronics, Inc., Geneva, Ill., as sales manager. He was formerly employed by General Electric Co., Schenectady, N. Y.

Erico Products, Inc., Cleveland, has promoted *Ed Langhenry* to national sales manager for three of the firm's divisions — Cadweld Electrical Connection Div., Caddy Arc Welding Accessory Div., and the Caddy Toggle Clamp Div. With Erico since 1954, Langhenry has been midwestern regional sales manager.

Coyne

Harrington

The board of directors of Victor Equipment Co., San Francisco, has appointed *E. J. Coyne* vice president, gas division. He will be headquartered in the San Francisco office.

Air Reduction Sales Co., New York City, has appointed *Blaine G. Harrington* manager of its Kansas City district. He will be responsible for sale and distribution of all Airco products marketed through facilities there. Harrington succeeds *J. O. McElligatt*, who retired recently.

Lincoln Electric Co., Cleveland, has named *J. L. Munson* manager, administrative services. *R. F. Young* has been appointed credit manager, succeeding Munson.

Lincoln also has transferred *David J. Fullen* from Philadelphia to the York, Pa., sub-office. He is replacing *Gordon T. Collier*, who was transferred to Cincinnati. *Thomas Bauer*, who was recently appointed to Lincoln's staff, has been assigned to the Philadelphia office.

Died . . .

Samuel H. Shaykin, 72, founder and president of Chicago Welding Sales Co. and York Engineering Co., Chicago, died Sept. 6 after a brief illness. Mr. Shaykin was a pioneer in the welding industry, beginning his career in 1910 with Searchlight Acetylene Co. He continued with Air Reduction Co. when that firm absorbed Searchlight. In 1931 he founded Chicago Welding Sales. Mr. Shaykin is survived by his widow, Ida; a son, Dr. Maurice; a daughter, Mrs. Hattie Silver; three grandchildren and one great-grandchild.

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Eliminates Spatter Grinding After Welding

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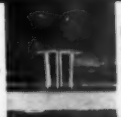

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Book Reviews

Material mechanics

MECHANICS OF MATERIAL. By Archie Hegden, Edward H. Ohlsen and William B. Stiles. Published by John Wiley & Sons, Inc., New York City, 1960. Cloth, 6 in. x 9 in., 502 pages. Price $7.75.

The authors, all authorities in their fields, have prepared what can generally be considered an excellent text for a course in the mechanics of material. Major emphasis has been placed on the elastic range of stress.

Where feasible, the presentation is extended to include an analysis of the plastic range of stress with appropriate problems. Examples and problems have been selected with special attention devoted to meeting the requirements necessary to understand the principles of mechanics of material without demanding excessive time for computation work. A working knowledge of statics and calculus should be considered to be essential to successfully study this book. Of considerable help is the fact that answers are given to about half the problems presented.

Chapter 10 is devoted to connections and it is found that the authors have devoted about 25 pages to riveted and welded connections. Most of the problems in this chapter are devoted to riveted joints for pressure vessels, something that went out of style 20 years ago.

Inspecting ship welds

THE INVESTIGATION OF RADIOISOTOPES FOR THE INSPECTION OF SHIP WELDS. Published by Office of Technical Services, U. S. Department of Commerce. By E. L. Criscuolo, D. P. Case and D. Polansky, 56 pages. Price $1.75.

This report is the result of a study conducted to explore the potentialities of radioactive isotopes for the inspection of welds in ship structures.

Various parameters were investigated to determine an optimum radiographic technique for the inspection of hull welds of ½- to 2-in. plate. Technique and sensitivity curves of thulium, iridium, cesium, and cobalt are included. Results are plotted on numerous graphs.

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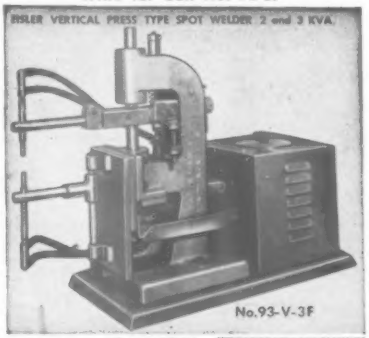

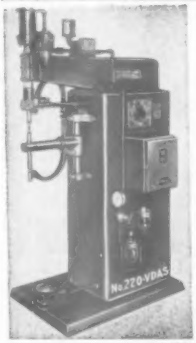

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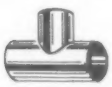

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Shielded arc processes

GAS SHIELDED-ARC WELDING PROCESSES. Published by American Welding Society, New York City, 1960, 76 pages.

During the last ten years welding progress has been little short of fantastic. New processes have been developed with such bewildering rapidity that industry is hard pressed to keep abreast of new developments. This book was published, according to the Society, because of the great need for a short, concise book on a relatively new process which has found wide acceptance.

Generously illustrated with photographs, line drawings, tables, and charts, the booklet covers Tig and Mig welding and cutting processes, equipment, and technique. Specific topics considered include current, shielding gases, filler metal, base metal, and cost estimating.

Safety talks

5-MINUTE SAFETY TALKS FOR FOREMEN. Published by the National Safety Council, Chicago, 1960.

Safety on the job is the central theme of these 52 5-minute talks, intended for job foremen. They range over such areas as motivation, materials, movement, machines and tools, and managing men.

Specific items covered include training the new worker, piling and storing materials, horseplay, power trucks and personnel, portable power tools, grinding wheels, first aid, work gloves, eye protection, locking switches, and many others applicable to the industrial field.

Radioisotopes

RADIOISOTOPES IN METALS ANALYSIS AND TESTING. Published by American Society for Testing Materials, Philadelphia, 1960, 62 pages, price $2.75.

A consolidated edition of the papers presented at the 62nd annual meeting of the ASTM, this publication covers the following topics:

Nucleonics in Analysis; Instrumentation for nucleonics; Metals analysis by radioactivation; Principles of isotope dilution assays; Neutron activation analysis of traces of molybdenum in tungsten; Application of the (n, alpha) reaction; Experience with neutron activation in the analysis of aluminum; and Training industrial personnel in radioisotope utilization.

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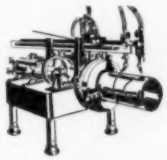

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Free Literature

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75. GRINDING WHEELS — Thermacote Co. Catalog contains information on firm's line of grinding wheels, includes specifications and prices.

76. X-RAY UNIT — Balteau Electric Corp. Flysheet briefly describes and depicts Model 150 portable X-ray machine.

77. HOSE FITTINGS — The Lenz Co. Illustrated, 12-page catalog lists sizes and specifications for low-pressure, reuseable hose fittings and one- and two-braid rayon hose made by firm.

78. WELDING APPARATUS — Liquid Carbonic Div., General Dynamics Corp. Thirty-four-page catalog No. 5900 in hard cover discusses firm's wide range of welding and cutting equipment, contains numerous illustrations.

79. ROLL FILM — E. I. DuPont de Nemours & Co. Various uses of Day Pack roll film are described in attractive folder A-14683.

80. CONVECTION FURNACES—Hevi-Duty Electric Co. Bulletin 660, 12 pages, goes into design, specifications, and functioning of pit type convection furnace.

81. MANUAL WELDING EQUIPMENT — Linde Co. Nineteen-page booklet F-7979F covers uses of manual Tig welding torches and accessories, including electrodes, cups and nozzles, and gases.

82. SILVER BRAZING — Engelhard Industries, Inc. Data on flux selection, information on proper methods of flux application for different types of brazing operations, are contained in 16-page booklet, "A complete guide to selective fluxing for low-temperature silver brazing."

83. SEAM WELDER BEARING—Taylor-Winfield Corp. Brochure 6-023 contains photographs and drawings of firm's current collector type of seam welder bearing.

84. POWER TOOLS — Skil Corp. New full-line catalog has photos and condensed specifications of power tools for building and construction, mechanical trades, etc. Eight-page, two-color publication F14626 covers drills, routers, planes, belts and disc sanders, shears, drivers, portable and bench grinders, polishers, blowers, etc.

85. SEPARATING EQUIPMENT — Wheelabrator Corp. Four-page Bulletin 402 describes complete line of magnetic and mechanical separating equipment. Capacities, specifications, and operating features of four models are described in the bulletin.

86. WELDING PLATENS — Acorn Iron and Supply Co. Welding platens, tools and accessories are briefly featured in flysheet.

87. WELDING SHIELDS — Diamonite Products Mfg. Co. High alumina ceramic welding shields are covered in four-page folder which includes clear illustrations of various models of cups and nozzles.

88. CYLINDER VALVES — Bastian-Blessing Co. Firm's complete line of

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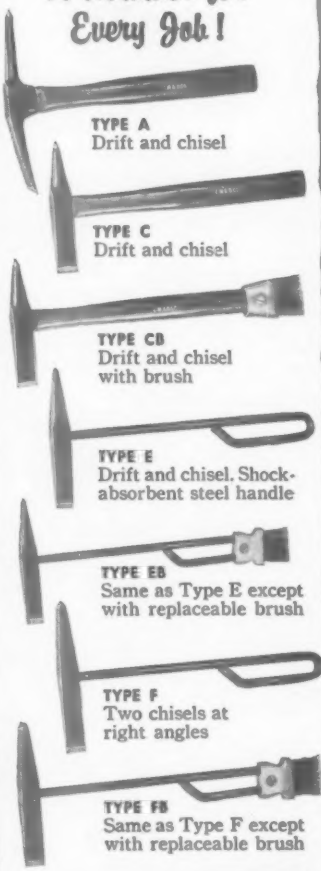

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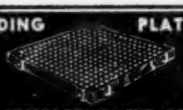

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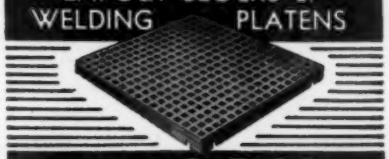

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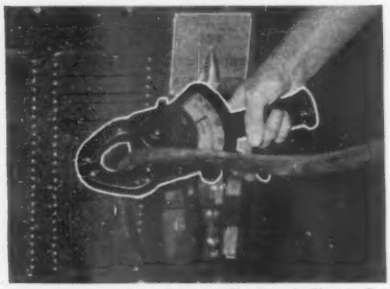

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104. WHEEL DRESSER — L. Newman Catalog shows all of firm's tangential angle wheel dressers and parts, including surface grinder dressers for use with or without magnetic check, and rotary type grinder dressers in both standard and special models.

105. MECHANICAL PRESS BRAKES — Cleveland Crane & Engineering Co. Revised catalog No. 2023-B, 50 pages, highly illustrated, covers latest features and new models added to Steelweld Press line.

106. SHEARING MACHINES — American Pullmax Co., Inc. Folder pictures and contains brief specifications for several models of firm's economy line of shearing and forming machines.

107. TRAINING AIDS — Hobart Bros. Co. Fifty helpful welding training aids are listed and described in folder, including books, charts, films, codes and specifications.

108. X-RAY LITERATURE — Philips Electronic Instruments. Twenty-page list of references spans the years from 1930 to 1960, giving authors' and publication names, article titles and publication dates for 376 papers on X-ray analysis subjects.

109. ROTARY TABLES—Chicago Tool and Engineering Co. Nineteen-page booklet covers firm's line of rotary and indexing tables, includes specifications and prices.

110. SILVER ALLOY BRAZING — Handy & Harman. Bulletin 20 is an introduction to the technique of silver brazing.

111. COMBUSTION SAFEGUARDS — Selas Corp. of America. Bulletin CS-2 presents an improved line of automatic firechecks and new design safety blowout.

112. THYRATON TUBE — National Electronics, Inc. Data sheets list technical information on new model industrial thyratrons — NLC6J and NL6989/C6J/KL.

114. SOUND CONTROL—Allied Witan Co. Increasing efficiency and productivity with sound control devices is illustrated in 12-page catalog. Typical applications, including use on welding equipment, are included.

115. ANGLE GRINDER — Technica Corp. Firm's universal angle grinder and accessories are illustrated with photographs and detailed in folder.

116. ADHESIVES PROPERTIES — Furane Plastics Inc. Chart contains latest information on epoxy adhesives, their application, cure times and physical properties; reverse side of chart contains such information as test methods, application suggestions, and availability.

117. CABLE CONNECTORS — Chicago Tool and Engineering Co. Catalog No. 36 lists specifications as well as prices for Palmgren line of welding cable and terminal connectors.

118. TOGGLE CLAMPS—Universal Engineering Co. Catalog contains specifications and descriptions of complete line of toggle-action clamps.

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WELDING

INFO-AIDS

USE THIS CARD for literature, catalogs, and bulletins shown on preceding pages and on the following page, and for more information on advertisments in this issue

Also information about

NEW PRODUCTS described on pages 100 to 109

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For copies of any manufacturers' bulletins described on these pages or for more data on the ads in this issue, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 100.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

★Post card not valid after three (3) months. After that, write *directly to the manufacturer*, describing fully the information and/or literature wanted.

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Welding Engineer
P.O. Box 28
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Advertisers' Literature

Literature offered in advertisements which were received up to the 5th of last month. To get the literature you want, circle numbers on Reader Service Card on this page.

225. Allied Piping Products Corp. — Brochure No. 5-60 available on Allied saddle fittings.

190. All-State Welding Alloys Co., Inc. — Instruction Manual and Aluminum Manual available, to help you select the alloy and flux best suited for each job.

166. American Platinum & Silver Div. — "A Complete Guide To Selective Fluxing For Low Temperature Silver Brazing" is available.

167. Ampco Metal, Inc. — Bulletin W-17 available, describing "Phos-Trode" electrodes.

222. Anti-Borax Compound Co., Inc. — Descriptive circular and sample of brazing flux available.

227. Auto Crane Co. — Illustrated literature, specifications anl price lists on all models of Auto Crane available.

196. Bastian Blessing Co. — Catalog GF-300 on "RegO" Adapters and Fittings and other compressed gas control equipment is available.

214. Becker Brothers Carbon Co. — Catalog available on Becker "Keen-Cut" electrodes.

154. Bernard Welding Equipment Co. — Bulletin 102 available on Bernard cable connectors.

202. Blackhawk Industrial Div. — Booklet available, "Hydraulic Tool Ideas for metal fabrication"

200. Branson Instruments, Inc. — Bulletin T-208 and T-200 available on "Sonoray" flaw detection for precision ultrasonic measurements.

186. The Budd Co. — Gamma Radiography Bulletin available.

194. Cam-Lok Div. — Bulletin No. 301 available on Receptacles and Plugs.

231. Columbia Electric Mfg. Co. — Catalog WE-400 available on the Tong-Test Ammeter to get the exact amperage for your welding job.

218. Cooper Welders, Inc. — Price list available on Cooper's welders.

224. Eisler Engineerng Co., Inc. — Catalog No. 93-57 available on spot and wire butt welders and the vertical type press welder.

215. Galv-Weld Products — Information and sample of galvanizing manufactured by Galv-Weld.

209. Gevaert Co. of America, Inc. — Write for a Handy Exposure Calculator for either CO 60 or IR 192 Radiography of Steel.

207. H&M Pipe Beveling Machine Co. — Catalog sheets available on the new H&M "Bevel-land" grinder.

201. Handy & Harman — Bulletin 20 on silver brazing and its benefits available.

165. Harnischfeger Corp. — Bulletin W-158 available on P&H engine driven welders.

157. The International Nickel Co., Inc. — "Now You Can Weld Dissimilar Alloys Quickly and Easily" is a folder on joining dissimilar alloy combinations with Inco-Weld "A"

206. Manhattan Rubber Div. — Bulletin 7157 further explains the Manhattan safety back flared cup and other heavy duty abrasive wheels.

182. Merrill Brothers — Catalog C-2 describes the Horizontal Plate Clamp and other material handling devices manufactured by Merrill.

185. Metal & Thermit Corp. — Electrode selector booklet on "Murex" electrodes available.

179. Norton Co. — A complete guidebook on grinding available, "Norton Grinding Wheels for the Welding Trade."

188. Page Steel & Wire Div. — Folders DH-402-C and DH-1218 contains information on submerged arc and inert gas automatic welding wire manufactured by Page.

226. Steffan Mfg. Corp. — Brochure No. CC-5M available on Steffan automatic contour cutter.

170. Titan Metal Mfg. Co. — Folder describing Titan welding rod compositions and uses available, "Titan Bronze Welding Rods."

193. Tuffaloy — Air Reduction Sales Co.— Catalog available describing the RW Taper numbering system for spot welding electrodes.

228. Tweco Products, Inc. — For information on the complete line of Tweco accessories write for a copy of "Twecolog."

164. Vernon Tool Co., Ltd. — Bulletin No. P-10 on Vernon Pipe-cutting pantograph available.

204. The Webb Corp. — Catalogs on plate fabricating machinery available.

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DOWN-TO-EARTH FACTS about ground clamps

GIVES a quick, positive and portable ground connection.
INCREASES machine and operator efficiency.
ALLOWS proper placement of ground to eliminate arc blow.
MAKES holders and cable run cooler, last longer.
CUTS current consumption. Reduces power costs.

Only TWECO GROUND CLAMPS offer all these features:

Copper Hinge Pin Allows Both Jaws To Carry Current

Strong Spring Fully Insulated

Support Ring Stops Cable Strand Breakage

Extended Lip — Shoves on to Work Easily

Jaws Made of 98% Copper Alloy

Exclusive Ball-Point Cable Connection. Cable Attached in Two Minutes

TWECO GROUND CLAMPS MADE IN 200, 300 & 500 AMP SIZES

TWECO CABLE CONNECTORS

WRITE FOR FREE TWECOLOG SHOWING THE COMPLETE LINE OF TWECO ACCESSORIES

TWECOTONG ELECTRODE HOLDERS

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MANUFACTURERS: ARC WELDING ELECTRODE HOLDERS, GROUND CLAMPS, CABLE CONNECTORS, TWECO-LITE ALUMINUM WELDING CABLE

PRODUCTS, INC.

P. O. BOX 666 • Factory: Boston at Mosley • Phone AMherst 5-1684 • Wichita 1, Kansas

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Diesel and Gasoline Engine Driven Welders and Welder/Power Plants

miller
ELECTRIC MANUFACTURING CO., INC.
APPLETON • WISCONSIN

Above welders are two of Miller's newest. DD-250-L (top) is driven by Hercules 38 h.p. diesel, produces 250 amperes d-c at 40 volts, 100% duty cycle. Auxiliary power: 12 KW a-c, or, 6.5 KW a-c while welding, or, 1 KW d-c while welding.

Lower model is ac-dc welder with air cooled 25 h.p. Kohler engine. Delivers 300 amperes a-c at 30 volts or 225 amperes d-c at 30 volts — both at 100% duty cycle. Auxiliary power: 7 KW a-c, or, 1 KW d-c while welding.